**IN THE UNITED STATES DISTRICT COURT**
**FOR THE EASTERN DISTRICT OF TEXAS**
**MARSHALL DIVISION**

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|---|---|
| SK NEXILIS CO., LTD.,<br><br>Plaintiff,<br><br>v.<br><br>SOLUS ADVANCED MATERIALS CO., LTD., VOLTA ENERGY SOLUTIONS S.A.R.L., VOLTA ENERGY SOLUTIONS EUROPE KFT., VOLTA ENERGY SOLUTIONS HUNGARY KFT., AND VOLTA ENERGY SOLUTIONS CANADA INC.<br><br>Defendants. | Civil Action No. 2:23-cv-00539-JRG-RSP<br>**JURY TRIAL DEMANDED** |

**DEFENDANTS' P.R. 3-3 INVALIDITY CONTENTIONS**

Pursuant to P.R. 3-3, Defendants Volta Energy Solutions S.A.R.L. ("VES"), Volta Energy Solutions Europe KFT. ("VESE"), Volta Energy Solutions Hungary KFT. ("VESH"), Volta Energy Solutions Canada Inc. ("VES Canada"), and Solus Advanced Materials Co., Ltd. ("Solus"), hereby provide their Invalidity Contentions and accompanying document production with respect to the claims identified by Plaintiffs SK nexilis Co., Ltd. ("SKN") in their Patent Rule 3-1 Disclosures.

The citation of prior art herein and the accompanying exhibits are not intended to reflect Defendants' claim construction contentions, which will be disclosed in due course in accordance with the Docket Control Order and may instead reflect Plaintiff's apparent (and potentially erroneous) claim constructions based on its Infringement Contentions.



SK nexilis EX2010
Solus v. SK nexilis
IPR2024-01462

## I. Introduction

As disclosed in its P.R. 3-1 Infringement Contentions served on Defendants, Plaintiff asserts the following patents and claims:

| U.S. Patent No. | Asserted Claims | Plaintiff's Alleged Priority Date |
|---|---|---|
| 9,457,541 | 1-4 | July 15, 2010 |
| 10,480,090 | 1-6 | June 24, 2015 |
| 10,811,689 | 1-5 | October 12, 2016 |
| 11,346,014 | 1-2, 4 | September 1, 2017 |
| 11,591,706 | 1-5 | January 31, 2018 |

The patents identified above are referenced as "the Asserted Patents," and the claims identified above are referenced as "the Asserted Claims," unless reference is made specifically with respect to particularly identified one or more of the Asserted Patents and/or one or more of the Asserted Claims. By identifying Plaintiff's alleged priority date for the Asserted Claims of each patent above, Defendants do not concede that Plaintiff's claims of priority are correct.

As further detailed in and supported by these Invalidity Contentions, Defendants contend that each of the Asserted Claims is invalid under at least 35 U.S.C. §§ 102, 103, and/or 112.[1] Defendants reserve the right to prove the invalidity of the Asserted Claims on bases other than those required to be disclosed in these disclosures pursuant to P.R. 3-3.

[1] References to Title 35 of the United States Code are to statutes prior to amendment under the America Invents Act ("AIA"), to the extent that the Asserted Patents have effective filing dates prior to applicable AIA effective dates, and to the current statutory provisions with respect to Asserted Patents having effective filing dates after the applicable AIA effective dates.

### A. Amendment/Supplementation

Defendants base these Invalidity Contentions on their current knowledge and understanding of the Asserted Patents, Plaintiff's Infringement Contentions, and the other facts and information available as of the date of these Invalidity Contentions. These are not, and are not intended to be, final statements or admissions.

Defendants' Invalidity Contentions pertain to the Asserted Claims as identified in Plaintiff's Infringement Contentions. Moreover, Plaintiff's Infringement Contentions provide boilerplate language for many of the Asserted Claim limitations and fail to provide any mapping to the accused products, largely relying on information and belief. Plaintiff has also provided insufficient contentions regarding their allegations of infringement under the doctrine of equivalents. Plaintiff has not sufficiently provided any contentions that identify the basis for Plaintiff's position regarding each limitation allegedly infringed under the doctrine of equivalents and its alleged equivalent element in the accused products. Should Plaintiff be granted leave to amend its contentions, Defendants reserve the right to amend or supplement these Invalidity Contentions as appropriate.

Further, this case is still at an early stage. Discovery has just begun, the Court has not issued a *Markman* order, and Plaintiff has so far provided little information and few documents in discovery. Defendants also have not yet deposed the inventors of the Asserted Patents, and discovery remains ongoing for these patents. Defendants may further rely on inventor admissions concerning the scope or state of the prior art relevant to the Asserted Claims, the prosecution histories of the Asserted Patents, related patents and/or related patent applications, any deposition or trial testimony of the named inventors on the Asserted Patents, the papers filed and any evidence produced or submitted by Plaintiff in connection with these cases or other related litigation, and the findings of fact or conclusions of law of any judicial or administrative body in connection with

these cases or other related litigation. Defendants reserve the right to contend that one or more of the Asserted Claims are invalid under 35 U.S.C. § 102(f) in the event Defendants obtain evidence that one or more of the named inventors did not invent the subject matter in the Asserted Claims.

Defendants' investigation and analysis of the prior art remains ongoing, including of prior art identified in these disclosures or not yet known to Defendants, of third-party prior art, and of related evidence, documents, information, and witnesses. Defendants' investigations and discovery into third party sources of prior art are also underway. Defendants may therefore amend their Invalidity Contentions upon receipt of additional discovery from Plaintiff or third parties and as Defendants' own investigation and analysis continues.

Defendants also expect to perform testing including, for example, testing relevant to showing that the prior art anticipates and renders obvious the Asserted Claims as well as testing relevant to defenses under 35 U.S.C. § 112 including written description, non-enablement and indefiniteness defenses. While the Asserted Claims recite a number of limitations that are purportedly assessed through testing, Plaintiff has not disclosed any of the procedures or results from its own testing or otherwise produced relevant testing standards notwithstanding requests by Defendants. Defendants may therefore amend their Invalidity Contentions upon completing additional investigation and analysis and performing testing.

Accordingly, Defendants reserve all rights to amend, modify, or supplement these contentions based on information learned through further investigation or discovery following the date of these Invalidity Contentions, in view of Court's construction of the Asserted Claims, in response to any findings as to the priority date of the Asserted Claims, in responses to positions that Plaintiff or expert witness(es) may take concerning claim construction, infringement, and/or invalidity issues, and for any other proper reason.

Defendants further reserve the right to supplement their accompanying P.R. 3-4(b) document production should they later discover additional prior art documents, information, testimony, prior art systems and related documentation, and/or software or hardware code, including information provided by third parties after the date of service of these Invalidity Contentions.

**B. Claim Construction**

Defendants' Invalidity Contentions are based on Defendants' current understanding of the Asserted Claims and Plaintiff's apparent view of the scope of those claims as shown, for example, in Plaintiff's Infringement Contentions. A *Markman* Order in this case has not yet been issued, and in no way shall these Invalidity Contentions be taken as any admission or acquiescence by Defendants as to the proper scope of the Asserted Claims and/or proper claim constructions of terms and phrases recited in those claims. By identifying prior art that anticipates and/or renders obvious the Asserted Claims, Defendants do not admit that the claim limitations are capable of construction, do not admit that any claim limitations are supported with an appropriate written description and enabling disclosure in the applicable patent specifications, and do not adopt Plaintiff's apparent claim constructions or admit the accuracy of any particular claim construction.

Nothing stated herein shall be construed as an admission or a waiver of any particular construction of any claim term or as an admission that Defendants agree with Plaintiff's apparent interpretation of the claims. These Invalidity Contentions are not, and shall not be used as, evidence of Defendants' claim construction positions or contentions. Furthermore, nothing in these Invalidity Contentions shall be treated as an admission that Defendants' accused products meet any limitation of the Asserted Claims. References to the preamble of a claim in these Invalidity Contentions are not an admission that the preamble is, in fact, a limitation of a claim.

## II. P.R. 3-3(a): Identification of Prior Art

Pursuant to P.R. 3-3, and subject to Defendants' reservation of rights, Defendants identify the prior art in the tables below that anticipates or renders obvious one or more Asserted Claims under 35 U.S.C. §§ 102 and 103 based on the alleged priority dates of the Asserted Patents.[2]

**Prior Art Patents and Patent Publications (Table 1-A)**

| Patent/Application No. | Country of Origin | Date of Issue/Publication | Priority Date |
|---|---|---|---|
| 9,209,485 (Cheng) | United States | January 29, 2015 | March 18, 2014 |
| 2015/0267313 (Chou) | United States | September 24, 2015 | September 15, 2014 |
| 8,715,836 (Dobashi) | United States | February 19, 2009 | March 9, 2007 |
| 2014/0291156A1 (Ezura) | United States | October 2, 2014 | October 30, 2012 |
| 2010/0136434 (Hanafusa) | United States | June 3, 2010 | April 8, 2008 |
| 2003/051340A (Hara) | Japan | February 21, 2003 | August 7, 2001 |
| 2009/0061326A1 (Hirose) | United States | March 5, 2009 | May 20, 2008 |
| 2008/0176144A1 (Iwama) | United States | July 24, 2008 | June 25, 2007 |
| 2010/0125044A (Kim) | Korea | November 30, 2010 | May 20, 2009 |
| 6,153,077 (Kato) | United States | November 28, 2000 | August 30, 1996 |
| 9,457,541 (Kim) | United States | October 4, 2016 | February 17, 2011 |
| 10-2017-0000761 (Kim) | Korea | January 3, 2017 | April 28, 2016 |
| 2013/0108887 (Kim) | United States | May 2, 2013 | December 20, 2012 |
| 20180119301A1 (Kim) | United States | May 3, 2018 | April 28, 2016 |
| 9,711,799 (Lai) | United States | July 18, 2017 | October 3, 2016 |
| 2016/0260980 (Lee) | United States | September 8, 2016 | October 14, 2013 |
| 0851944EP (Otsuka) | EP | July 8, 1998 | September 16, 1996 |
| 2004/0029006A1 (Otsuka) | United States | February 12, 2004 | July 29, 2003 |
| 2007/0287020 (Saito) | United States | December 13, 2007 | June 6, 2007 |
| 2006/0191798 (Sano) | United States | August 31, 2006 | April 3, 2003 |
| 2013/0108922 (Shinozaki) | United States | May 2, 2013 | June 28, 2011 |
| 9,293,771 (Tani) | United States | May 9, 2013 | December 28, 2012 |

[2] Defendants' disclosure of prior art is premised on the alleged priority dates of the Asserted Patents as identified in Plaintiff's P.R. 3-1 infringement contentions. Defendants reserve the right to contend Plaintiff is not entitled to the alleged priority dates and reserve the right to modify, amend, or supplement their invalidity contentions with additional prior art references if any Asserted Claim is shown to not be entitled to the respective alleged priority date or if Plaintiff alleges any other priority date for any of the Asserted Claims. Notwithstanding that reservation of rights, Defendants also reserve the right to argue that they have been unduly prejudiced should Plaintiff allege a different priority date for any of the Asserted Claims, and that accordingly Plaintiff should not be allowed to do so.

## Prior Art Publications (Table 2-A)

| Title | Date | Author | Publisher |
|---|---|---|---|
| "Copper Foil Smooth on Both Sides for Lithium-Ion Battery", Ch. 10 of Copper Electrodeposition for Nanofabrication Electronics Device | 2014 | Akitoshi Suzuki and Jun Shinozaki | Springer New York, NY |
| Characterization of Electrodeposited Copper Foil Surface Roughness for Accurate Conductor Power Loss Modeling | 2014 | Michael B. Griesi | University of South Carolina |

## Prior Art Devices, Systems, and Technologies (Table 3-A)

| Name of Device, System, or Technology | Date of Sale / Offer for Sale / Public Use |
|---|---|
| Samsung i8000 Omnia II | December 2009 |
| Samsung Rugby II | June 2010 |
| Samsung Galaxy Tab 3 | July 2013 |
| Samsung Galaxy Tab 4 | June 2014 |
| Samsung Galaxy Tab 4 8.0 | June 2014 |
| Samsung Galaxy Tab Pro 8.4 | February 2014 |
| Samsung Galaxy Tab Pro 10.1 | March 2014 |
| Samsung Galaxy Tab S 8.4 | July 2014 |
| Samsung Galaxy Tab S 10.5 | July 2014 |
| Samsung Galaxy Note 2 | October 2012 |
| Samsung Galaxy Note 3 | September 2013 |
| Samsung Galaxy SII | August 2011 |
| Samsung Galaxy SIII | May 2012 |
| Samsung Galaxy S4 | April 2013 |
| Samsung Galaxy S5 | April 2014 |
| Apple iPhone 1 | June 2007 |
| Apple iPhone 3G | July 2008 |
| Apple iPad 4G | November 2012 |
| Apple iPod Touch 3G | September 2009 |
| Motorola Droid | November 2009 |
| Kindle DX | May 2009 |
| Archos 604 | August 2006 |
| Archos 605 | August 2007 |
| ThinkPad T410 | March 2010 |
| ThinkPad T410i | January 2010 |
| ThinkPad T410s | November 2010 |
| ThinkPad T510 | January 2010 |
| Think Pad Edge 13" | January 2010 |
| Think Pad XI Carbon 2nd Gen | January 2014 |

| Name of Device, System, or Technology | Date of Sale / Offer for Sale / Public Use |
|---|---|
| MacBook Pro (2014) | July 2014 |
| MacBook Air (2014) | April 2014 |
| CFL Samples | May 2012 |

Each prior art patent, publication, or product identified above was either effectively filed or issued (for patents), published (for publications) or known, used, offered for sale or sold (for products) before either the earliest claimed priority date to which it is applied for invalidity, and none appears to have been abandoned, suppressed, or concealed, so each such reference also constitutes evidence of prior invention pursuant to 35 U.S.C. § 102(g), if it is in the U.S. The persons or entities involved with each such invention include the named inventors on the above-identified patents, the authors listed on the above-identified publications, and the entities and individuals identified in connection with the above-identified products.

Some or all of the systems identified above or identified in the prior art publications and patents provided by Defendants will be the subject of continuing investigation and discovery, including currently uncompleted third party discovery. Defendants reserve the right to supplement their contentions consistent with the Federal Rules and the Patent Rules, in the event that additional information is discovered relating to these systems. To the extent that one or more documents (e.g., user manual) may be used to describe aspects of a particular device, that device is a single reference for prior art purposes under 35 U.S.C. § 102. Some or all of the corroborating references may also separately qualify as prior art publications under 35 U.S.C. § 102 and may be used as invalidating references under 35 U.S.C. §§ 102 and/or 103.

Because Defendants have not yet completed discovery in this case, including taking depositions of the named inventors, and otherwise obtaining discovery from Plaintiff and third parties, Defendants reserve the right to supplement these contentions with facts, documents, or

other information learned at a later point through discovery or further investigation.

## III. P.R. 3-3(b): Invalidity Grounds

Pursuant to P.R. 3-3(b), Defendants contend that certain prior art references below anticipate one or more Asserted Claims and that to the extent the identified prior art references do not anticipate the Asserted Claims, those claims are invalid as obvious under 35 U.S.C. §103. Each anticipatory prior art reference, either alone or in combination with other prior art, also renders the Asserted Claims invalid as obvious. In particular, each anticipatory prior art reference may be combined with (1) information generally known to persons skilled in the art at the time of the alleged invention, and/or (2) any of the other identified prior art references. To the extent that Plaintiffs contend that any of the anticipatory prior art fails to disclose one or more limitations of the Asserted Claims, Defendants contend that any difference between the reference and the corresponding patent claims would have been obvious to one of ordinary skill in the art. Thus, all anticipation charts should be interpreted as both reflecting anticipation by the reference as well as invalidity due to single reference obviousness, to the extent that Plaintiffs contend that any limitation is missing.

Defendants' obviousness contentions and combinations are provided in the alternative to their anticipation contentions and are not to be construed to imply that any prior art reference included in the combinations is not by itself anticipatory. Defendants may present obviousness contentions and combinations in addition and as an alternative to an assertion of anticipation.

### A. Anticipation

Pursuant to P.R. 3-3(a) and 3-3(b), Defendants identify the prior art references that anticipate or render obvious the Asserted Claims in the claim charts of Exhibits A1-A23 ("Appendix A") which are hereby incorporated by reference as if fully set forth herein. The claim charts provide an explanation showing how these prior art references teach or suggest each and

every element of the Asserted Claims. For each reference or combination of references suggested by each chart, Defendants indicate whether the prior art renders the claim anticipated and/or obvious pursuant to P.R. 3-3(b).

Defendants further incorporate by reference, as if set forth fully herein, all prior art cited during the prosecution of the Asserted patents, all prior art and invalidity arguments as described in any future *inter partes* review proceedings of the Asserted Patents, and all prior art and invalidity arguments disclosed during previous litigation proceedings. Defendants further identify and hereby incorporate by reference as if set forth fully herein the prior art references and invalidity contentions as described in any proceeding wherein invalidity contentions have been, or will be, provided regarding the Asserted Patents, foreign counterparts, or any parent or child patent(s). Defendants reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted.

As discovery is ongoing, Defendants continue to investigate these items and to reserve the right to amend or supplement these contentions to include additional information or documents regarding such products and/or systems.

**B. Obviousness**

Pursuant to P.R. 3-3(b), Defendants contend that certain prior art references identified in Appendix A anticipate one or more Asserted Claims and that to the extent the identified prior art references do not anticipate the Asserted Claims, those claims are invalid as obvious under 35 U.S.C. §103. Each prior art reference in Appendix A, either alone or in combination with other prior art, also renders the Asserted Claims invalid as obvious. In particular, each prior art reference in Appendix A may be combined with (1) information generally known to persons skilled in the

art at the time of the alleged invention, and/or (2) any of the other prior art references in Appendix A and/or (3) any of the other prior art references in Appendix B. Appendix B further identifies motivations to combine the prior art references pursuant to P.R. 3-3(b).

To the extent that Plaintiff contends that any of the prior art in Appendix A fails to disclose one or more limitations of the Asserted Claims, Defendants contend that any difference between the reference and the corresponding patent claims would have been obvious to one of ordinary skill in the art. Thus, all Appendix A charts should be interpreted as both reflecting anticipation by the reference as well as invalidity due to single reference obviousness, to the extent that Plaintiff contends that any limitation is missing.

To the extent a finder of fact determines that a limitation of the Asserted Claims is not disclosed by one of the references in Appendix A, modifying the reference to include the limitation does not go beyond combining familiar elements according to known methods to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art and/or a finite number of such alternatives. Thus, to the extent that an Asserted Claim is not anticipated, it is nevertheless invalid as obvious.

In *KSR International Co. v. Teleflex, Inc.*, the United States Supreme Court held that, among other things, "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." 550 U.S. 398, 416 (2007); *see also id.* at 417 ("[A] court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions."). In particular, a patent is obvious where "the content of the prior art, the scope of the patent claim, and the level of ordinary skill are not in material dispute, and the obviousness of the claim is apparent in light of these factors." *Id.* at 427. The Supreme Court found that "if a technique has been used to improve one device, and a

person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id.* at 417.

Moreover, the Supreme Court recognizes that market pressures will motivate a person of ordinary skill to survey known art for solutions to problems. *Id.* at 421 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp."). When a person of ordinary skill uses an identified, predictable solution to solve a problem, "it is likely the product not of innovation but of ordinary skill and common sense." *Id.* In addition, when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. *Id.* at 417. If a person of ordinary skill can implement a predictable variation, U.S.C. § 103 bars its patentability. *Id.*

"'[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.'" *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1379 (Fed. Cir. 2023) (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007)). "Additionally, 'universal' motivations known in a particular field to improve technology provide 'a motivation to combine prior art references ***even absent any hint of suggestion*** in the references themselves.'" *Id.* (quoting *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 797-99 (Fed. Cir. 2021)) (original emphasis). Thus, motivations to combine, as well as the general state of the art, may be found in a variety of places including, but not limited to, in the references defined above, and the specification of the Asserted Patents. For example, each piece of prior art relates to systems and methods for copper foils. A person of

ordinary skill in the art at the time of the alleged invention would have been motivated to combine any one piece of identified prior art with any other identified piece of prior art. For at least this reason, it would have been obvious to a person of skill in the art at the time of the alleged invention of the Asserted Claims to combine the various references cited herein so as to practice the Asserted Claims and there is a motivation in the art to make such a combination. Further reasons to combine the references identified in these charts include the nature of the problem being solved, the express, implied, and/or inherent teachings of the prior art, the knowledge of persons of ordinary skill in the art, the fact that the prior art is generally directed towards methods and systems for copper foils, that such combinations would have yielded predictable results, and that such combinations would have represented known alternatives to a person of ordinary skill in the art.

The law does not require evidence of a specific motivation to combine prior art where the combination would yield expected results and at most simply represents a known alternative or design choice to one of skill in the art. *See Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017); *KSR Int'l Co. v. Teleflex, Inc*., 127 S. Ct. 1727, 1739-40 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, and instead applying an "expansive and flexible" approach). Indeed, the Supreme Court held that a POSITA is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *KSR*, 550 U.S. at 420-21.

Nevertheless, in addition to the information contained immediately above and elsewhere in these contentions, Defendants identify additional motivations and reasons to combine. For example, in addition to the specific motivations identified herein, motivation to modify a particular

reference or to combine any two or more of the identified references comes from (a) the nature of the problem being solved, (b) the teachings of the prior art, (c) the knowledge of persons of ordinary skill in the art, (d) the fact that all of the references teach systems, apparatuses, and methods related to the subject matter and address the same technical issues described in the Asserted Patents, and (e) one would be motivated by considerations of efficiency, effectiveness, convenience, cost-savings, and accessibility, to combine the various teachings of the references. Additionally, one would be motivated to address the alleged problems or achieve the purported objectives identified in the Background sections of the Asserted Patents, of the references cited on the face of the Asserted Patents, and of the other references cited herein.

In sum, motivations to modify or combine the identified references including the references listed above can be found via, for example, discussions in the cited references, the state of the art discussed in the references, and the knowledge of one of ordinary skill in the art. One of ordinary skill in the art would have been motivated to combine these references, because these references relate to common objectives and subject matter. The references share commonalities in terms of their general subject matter as well as the types of equipment, products, systems, and/or methods used. Further, certain prior art references explicitly or implicitly reference other prior art references, share common authors or inventors, were published in the same journals, were compiled by a common author of a compilation or reference book, were presented at the same conferences, and/or were developed at common companies, schools, or organizations, which would motivate one of ordinary skill in the art to combine them. These references are within the field of the Asserted Patents and are directed to similar subject matter within the field. Additionally, the references, and any products, devices, or processes described in the references, existed and/or were invented in the same time period providing further motivation for combination.

These disclosures were provided without prejudice to any arguments or objections concerning the relevance of motivation to combine in connection with any invalidity contentions.

Defendants reserve the right to further specify the motivations to combine the prior art in response to positions that Plaintiff may take later in this case and as discovery, including third party discovery, proceeds. Defendants may rely on any and all portions of the prior art, other documents, and expert testimony to establish that a person of ordinary skill in the art would have been motivated to modify or combine the prior art so as to render the claims invalid as obvious. Moreover, Defendants reserve the right to rely on later identified sources of information, including but not limited to witness testimony and other discovery, to establish the state of the art in the relevant time frame pertaining to the Asserted Patents.

Additionally, Defendants note that Plaintiff has neither provided any contention that secondary considerations of non-obviousness exist for any Asserted Patent nor provided any evidence of such secondary considerations. Defendants are not aware of any evidence supporting the existence of any such secondary considerations. This lack of evidence further renders the Asserted Claims obvious. Proving any such secondary considerations is Plaintiff's burden. *See, e.g.*, *ZUP, LLC v. Nach Mfg., Inc.*, 896 F.3d 1365, 1373 (Fed. Cir. 2018) ("[A] patentee bears the burden of production with respect to evidence of secondary considerations of nonobviousness."). To the extent Plaintiff is permitted to introduce contentions and/or evidence concerning secondary considerations in the future, Defendants reserve all rights to rebut those contentions if and when Plaintiff identifies them. In the meantime, Defendants note the complete lack of any such evidence in the record. Moreover, Defendants further contend that, in any event, the evidence of obviousness for each Asserted Claim is so overwhelming that secondary considerations are necessarily insufficient to rebut Defendants' showing. *See, e.g.*, *Ohio Willow Wood Co. v. Alps*

*South, LLC*, 735 F.3d 1333, 1344 (Fed. Cir. 2013) ("[W]here a claimed invention represents no more than the predictable use of prior art elements according to established functions, as here, evidence of secondary indicia are frequently deemed inadequate to establish non-obviousness.").

While Defendants reserve the right to rely on any combination of the references reflected in their charts or incorporated herein by reference, Defendants provide the following exemplary and non-exhaustive references and/or combinations evidencing invalidity of the claims of the Asserted Patents. The combinations of prior art listed below render obvious the Asserted Claims under the proper construction of the claims and/or under Plaintiffs' apparent interpretation of the claims as set forth by Plaintiff in its Complaint and Infringement Contentions.

### 1. Obviousness Rationale and Motivations to Combine

**Obviousness:** For at least the reasons described in these contentions, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those prior art references identified in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to meet the limitations of the Asserted Claims. As a result, the references identified herein render one or more Asserted Claims of the Asserted Patents obvious when the references are read in combination with each other, and/or when read in view of the state of the art and knowledge of those skilled in the art. Each and every reference identified is also relevant to the state of the art at the time of the alleged invention. Any of the references disclosed above may be combined with one another to render obvious (and therefore invalid) each of the Asserted Claims. Defendants may rely upon a subset of the identified references or all of the references identified herein, including all references in Appendix A and Appendix B, for purposes of obviousness depending on the Court's claim construction, positions taken by Plaintiffs during this litigation, and further investigation and discovery.

**Reservation of Rights:** As mentioned above, Defendants have not yet completed their search or discovery concerning additional prior art. As such, Defendants' inclusion of exemplary combinations does not preclude them from identifying other invalidating combinations as appropriate, and Defendants reserve the right to identify additional specific combinations as well as to detail and explain such combinations.

**No More Than Ordinary Variations of Prior Art; No Unexpected Results:** To the extent not anticipated, the Asserted Claims represent no more than the result of ordinary variations of the prior art. Defendants further believe that no showing of a specific motivation to combine prior art is required to combine the references disclosed above and in the attached charts, as each combination of art would have no unexpected results, and at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415-16 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation to combine test, instead espousing an "expansive and flexible" approach); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1058 (Fed. Cir. 2016); *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1344 (Fed. Cir. 2017). Indeed, the Supreme Court held that a person of ordinary skill in the art is "a person of ordinary creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420-21. Nevertheless, in addition to the information contained elsewhere in these contentions, Defendants identify motivation and reason to combine the cited art.

**Predictable Results; Obvious to Try:** One or more combinations of the prior art references identified in Appendix A and Appendix B would have been obvious because these references would have been combined using: known methods to yield predictable results; known

techniques in the same way; a simple substitution of one known, equivalent element for another to obtain predictable results; and/or a teaching, suggestion, or motivation in the prior art generally. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) (holding that "obvious to try" is a valid rationale for an obviousness finding); *see In re Cohen*, 767 Fed.Appx. 985, 988-89 (Fed. Cir. 2019) ("where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation") (quoting *In re Aller*, 220 F.2d 454 (CCPA 1955)); *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) ("A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective"). In addition, it would have been obvious to try combining the prior art references identified above because there were only a finite number of predictable solutions and/or because known work in one field of endeavor prompted variations based on predictable design incentives and/or market forces either in the same field or a different one. Further, the identified combinations of the prior art references would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

**Interrelated Teachings:** Additional evidence that there would have been a motivation to combine the prior art references identified above includes the interrelated teachings of multiple prior art references; common authorship; the effects of demands known to the design community or present in the marketplace; the existence of a known problem for which there was an obvious solution encompassed by the Asserted Claims; the existence of a known need or problem in the field of the endeavor at the time of the alleged invention(s); and the background knowledge that would have been possessed by a person having ordinary skill in the art.

**Same Area of Technology:** Additionally, it would be obvious to one of ordinary skill in the art to consult and/or combine any of the prior art listed in Appendix A and B because all of

these references relate to the same area of technology and/or are from analogous art. The Asserted Claims and the prior art are directed to copper foils. *See, e.g.*, '541 Patent at Abstract, Title, Claim 1; '090 Patent at Abstract, Title, Claim 1; '689 Patent at Abstract, Title, Claim 1; '706 Patent at Abstract, Title, Claim 1; '014 Patent at Abstract, Title, Claim 1. The Asserted Claims merely unite old elements, well known in the field, with no change in their respective function or result. Given the interrelated teachings of the prior art, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art, it would have been obvious for one of ordinary skill in the art to combine these familiar elements, disclosed and/or embodied in the prior art listed above to practice the Asserted Claims.

For example, the Asserted Patents and the prior art in Appendix A and Appendix B describe similar techniques for manufacturing copper foil or, more specifically, electrolytic copper foil. Given these similarities, a POSITA would have recognized the compatibility between the teachings of the prior art references.

**Same Technical Issues:** A person of ordinary skill would have been motivated to combine the above prior art based on his/her knowledge, the nature of the problem to be solved, and the teachings of the prior art. The identified prior art addresses the same or similar technical issues and suggests the same or similar solutions to those issues. Moreover, some of the prior art refer to or discuss other prior art, illustrating the close technical relationship among the prior art. For each of the Asserted Patents, one of ordinary skill in the art would have been motivated to combine known prior art solutions described in these Invalidity Contentions.

**Demand and Market Forces:** For example, market forces suggested a demand for increased quality in copper foil, and thus one of skill in the art would have thought to combine or

modify references that described known methods that one of skill in the art would have recognized as offering improvements to solutions of that time.

**Overlapping Ranges:** The measurement ranges in the Asserted Claims overlap with ranges for the same measurements in the prior art. A prima facie case of obviousness is established where claimed ranges overlap or fall within ranges taught by prior art. *See, e.g., In re Patel*, 566 Fed.Appx. 1005, 1010-11 (Fed. Cir. 2014) (acknowledging the establishment of obviousness when the claimed range "falls within the prior art range"); *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 782 (Fed.Cir. 1985).

**Known Elements; Obvious to Try:** Moreover, many of the claim elements were already known as admitted by the applicants in the patent specification. These elements represented design choices available to a person of ordinary skill. When there is a design need or market pressure to solve a problem such as identified previously and/or described in the Asserted Patents, and there are a finite number of identified, predictable solutions, a person of ordinary skill would be motivated to combine the known options that are within his or her technical grasp. For the Asserted Patents, there are a finite number of approaches to achieving the claimed measurements in the Asserted Claims including peak count roughness, peak density, ten-point mean roughness, surface roughness, thickness, coefficient of thermal expansion, tensile strength, yield strength, weight deviation, elongation, texture coefficients and preventing wrinkles.

Further, the Asserted Claims recite numerous characteristics of copper foils including, for example, peak count roughness, peak density, ten-point mean roughness, surface roughness, thickness, coefficient of thermal expansion, tensile strength, yield strength, weight deviation, elongation, texture coefficients and preventing wrinkles. Such elements, and the claimed ranges, were known to affect relevant properties of copper foils. A POSITA would have found it

obvious to modify these elements through routine experimentation to arrive at optimal values within the claimed ranges and would have had a reasonable expectation of success in doing so. The inclusion of such elements in the Asserted Claims does not render them novel or non-obvious. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007) (holding that "obvious to try" is a valid rationale for an obviousness finding); *see In re Cohen*, 767 Fed.Appx. 985, 988-89 (Fed. Cir. 2019) ("where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation") (quoting *In re Aller*, 220 F.2d 454 (CCPA 1955)); *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) ("A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective").

**Summary of Motivations to Combine:** Thus, the motivation to combine the teachings of the prior art references disclosed in Appendix A and Appendix B is found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained in simple substitution of one known element for another; (6) the use of a known technique to improve similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

**(a) Combinations**

For at least the reasons described above, it would have been obvious to one of ordinary

skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A or Appendix B, along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Claims.

Appendix A includes the following exhibits, which are prior art to the identified Asserted Patents:

| Exhibit No. | Reference | Asserted Patents |
|---|---|---|
| A-1 | 9,209,485 (Cheng) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-2 | 2015/0267313 (Chou) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-3 | 8,715,836 (Dobashi) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-4 | 2014/0291156A1 (Ezura) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-5 | 2010/0136434 (Hanafusa) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-6 | 2003051340A (Hara) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-7 | US20090061326A1 (Hirose) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-8 | 2008/0176144A1 (Iwama) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-9 | 6,153,077 (Kato) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-10 | 9,457,541 (Kim) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-11 | 10-2017-0000761 (Kim) | '689 Patent, '706 Patent, '014 Patent |
| A-12 | 2013/0108887 (Kim) | '090 Patent, '689 Patent, '706 |

| Exhibit No. | Reference | Asserted Patents |
|---|---|---|
| | | Patent, '014 Patent |
| A-13 | 9,711,799 (Lai) | '689 Patent, '706 Patent, '014 Patent |
| A-14 | 2016/0260980 (Lee) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-15 | 0851944EP (Otsuka) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-16 | 2004/0029006A1 (Otsuka) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-17 | 2007/0287020 (Saito) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-18 | 2006/0191798 (Sano) | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-19 | 2013/0108922 (Shinozaki) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-20 | 9,293,771 (Tani) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-21 | Suzuki, Ch. 10 "Copper Foil Smooth on Both Sides for Lithium-Ion Battery" | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-22 | 2018/0119301A1 (Kim) | '706 Patent |
| A-23 | Characterization of Electrodeposited Copper Foil Surface Roughness for Accurate Conductor Power Loss Modeling (Griesi) | '090 Patent, '689 Patent, '706 Patent, '014 Patent |
| A-24 | Prior Art Systems | '541 Patent, '090 Patent, '689 Patent, '706 Patent, '014 Patent |

For example, and without limitation, the Asserted Claims would have been obvious to one of ordinary skill in the art in view of the following combinations:

(i) '541 Patent

*[1] A copper foil for a current collector of a lithium secondary battery*

A POSITA would have had reason to combine references disclosing a copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a current collector of a lithium secondary battery—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) discloses a copper foil for a current collector of a lithium secondary battery. *See* A1-A23 at [1a] in Appx. A.

> *wherein, in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, wherein the texture coefficient satisfies the following equation . . . wherein I(hkl) represents a measured diffraction intensity with respect to a (hkl) surface, and I0(hkl) represents a standard diffraction intensity of ASTM (American Society of Testing Materials) standard powder-shaped diffraction data*

A POSITA would have had reason to combine references disclosing a copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having a crystalline

structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%—e.g., Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16) discloses a copper foil having a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited

and described in Appx B for this claim element. *See, e.g.,* Battey, PRIOR_ART-00000121.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the crystal structure that is reflected by a texture coefficient within the claim range positively affects adhesion and other mechanical properties of the copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*wherein the copper foil has a weight deviation of 3% or less*

A POSITA would have had reason to combine references disclosing a copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having a weight deviation of 3% or less—e.g., Hara (A6), Hirose (A7), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these

references. Each of Hara (A6), Hirose (A7) discloses a copper foil having a weight deviation of 3% or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Kubo, PRIOR_ART-00001459.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a non-uniform copper foil could lead to negative impacts including early life and defects. *See, e.g.*, Hara, PRIOR_ART-00000470 at [0007]. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*wherein the copper foil has a tensile strength of 30 to 40 kgf/mm2*

A POSITA would have had reason to combine references disclosing a copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having a tensile strength

of 30 to 40 kgf/mm$^2$—e.g., Hirose (A7), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16) discloses a copper foil having a tensile strength of 30 to 40 kgf/mm$^2$. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Bennett, PRIOR_ART-00000126.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a copper foil within this tensile strength range would yield a successful copper foil for the demands of a lithium ion battery. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*so as to prevent the generation of wrinkles at a surface of the copper foil*

A POSITA would have had reason to combine references disclosing a copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil with properties so as to prevent the generation of wrinkles at a surface of the copper foil—e.g., Hirose (A7), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Otsuka 006 (A16) discloses a copper foil with properties so as to prevent the generation of wrinkles at a surface of the copper foil. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Merchant, PRIOR_ART-00001561.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that wrinkles are deformities that can cause problems with copper foils in litium ion batteries . Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[2] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having a surface roughness (Rz-JIS) of 2 μm or less—e.g., Hirose (A7), Kato (A9), Otsuka 944 (A15), Otsuka 944 (A15), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Kato (A9), Otsuka 944 (A15), Otsuka 944 (A15), Otsuka 006 (A16) discloses a copper foil having a surface roughness (Rz-JIS) of 2 μm or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Nishimoto, PRIOR_ART-00001595.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all

directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an Rz-JIS surface roughness under 2 μm is suitable for copper foils used in lithium ion batteries. *See, e.g.*, Hanafusa, PRIOR_ART-00000463 at [0030] ("it is desirable that the surface roughness Rz of the electrolytic copper foil is 2.0 μm or less"). Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[3] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%.*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having an elongation of 3 to 20%—e.g., Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16) discloses a copper foil having an

elongation of 3 to 20%. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Matsuda, PRIOR_ART-00001544.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a copper foil with an elongation between 3% and 20% is desirable for copper foils used in lithium ion batteries to, e.g., withstand the contraction/expansion. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[4] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), or any other reference or system disclosing this limitation—with any one of the references disclosing a copper foil having

a thickness of 1 to 35 μm—e.g., Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), or any other reference or system disclosing this limitation. Each of Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18) concerns copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16) discloses a copper foil having a thickness of 1 to 35 μm. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Nishimoto, PRIOR_ART-00001595.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a copper foil with a thickness within the claimed range is desirable for copper foils used in lithium ion batteries to, e.g., account for the trade offs between needing a low thickness to improve flexibility while also needing a high enough

thickness to withstand breakage. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*Additional Combinations*

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Patents. For example, and without limitation, the Asserted Claims of the '541 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

| **Patent No. or Title (Primary Inventor/Author)** | **In Combination with One or More of: (Patent No. or Title (Primary Inventor/Author))** |
|---|---|
| Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), and any of the prior art systems listed in Table 3-A (A24). | Dobashi (A3), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), and any of the prior art systems listed in Table 3-A (A24), secondary references (Appx B), and/or the knowledge of those skilled in the art |

(ii) '090 Patent

*An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil for a secondary battery—e.g., Cheng (A1), Chou (A2),

Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20) discloses an electrolytic copper foil for a secondary battery. *See* A1-A23 at [1a] in Appx. A.

*a first surface; and a second surface opposite to the first surface*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil comprising a first and second surface—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16),

Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), and Griesi (A23) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil comprising a first and second surface. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.,* Wolski, PRIOR_ART-00002283.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that by employing known technologies for manufacturing copper foils, i.e., a drum, a POSITA would yield the predicable outcome of a 2-dimensional copper foil with two surfaces opposite each other. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23),and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100—e.g., Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Wolski, PRIOR_ART-00002283.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the first and second surfaces with Rpc values between 10 and 100 would be ideal because, e.g., an Rpc above 100 would result in non-uniformity, but an Rpc below 10 would create poor adhesion. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

> *wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at randomly-selected three points, the peak count roughness Rpc of each point is the number of effective peaks which rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940)*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm —e.g., Suzuki (A21), Dobashi (A3), Chou (A2), Shinozaki (A19), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Suzuki (A21), Dobashi (A3), Chou (A2), Shinozaki (A19), discloses an

electrolytic copper foil wherein the peak count roughness Rpc measured at 3 random points wherein the Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Fabian, PRIOR_ART-00000326.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would find it obvious to e.g., measure values at at least 3 randomly-selected points and follow the testing parameters specified. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and

Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks—e.g., Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Suzuki (A21), Dobashi (A3), Chou (A2), Shinozaki (A19), discloses an electrolytic copper foil having at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Griesi, PRIOR_ART-00000351.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that by following the known techniques for developing electrolytic copper foil that the resulting foil would, e.g., have peaks and valleys respectively above and below a criteria line of 0.5. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and second surfaces is 60 or less.*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a difference in peak count roughness Rpc between the first and second surfaces of 60 or less—e.g., Suzuki (A21), Chou (A2), Shinozaki (A19),or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Suzuki (A21), Chou (A2), Shinozaki (A19), discloses an electrolytic copper foil having a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited

and described in Appx B for this claim element. *See, e.g.*, Griesi, PRIOR_ART-00000351.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that electrolytic copper foils with an Rpc under 60 would result in copper foil that has, e.g., better uniformity. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[3] The electrolytic copper foil according to claim 1, wherein each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a ten-point mean roughness $R_{zJIS}$ of 2 μm or less—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), Griesi (A23), or any other reference

or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Nishimoto, PRIOR_ART-00001595.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil with an Rz-JIS of 2 μm or less is desirable because, e.g., it increases battery life. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[4] The electrolytic copper foil of claim 1, having a thickness of 3 to 20 μm*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a thickness of 3 to 20 μm—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a thickness of 3 to 20 μm. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Merchant, PRIOR_ART-00001561.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of

manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil between 3 and 20 μm thickness is desirable because, e.g., such a foil would be thick enough to withstand breakage but refrain from making the battery too large and heavy. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*and tensile strength of 30 to 60 kgf/mm2*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a tensile strength of 30 to 60 kgf/mm2—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10),

Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a tensile strength of 30 to 60 kgf/mm2. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Matsuda, PRIOR_ART-00001544.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand an electrolytic having a tensile strength within the claimed range is ideal because, e.g., it prevents slackness and breakage. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[5] A current collector for a secondary battery, the current collector comprising the electrolytic copper foil according to claim 1*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing a current collector for a secondary battery—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), , Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses a current collector for a secondary battery. *See* A1-A23 at [1a] in Appx. A.

*a protective layer disposed on the electrolytic copper foil*,

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi

(A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing a current collector for a secondary battery having a protective layer disposed on the electrolytic copper foil—e.g., Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Tani (A20) discloses a current collector for a secondary battery having a protective layer disposed on the electrolytic copper foil. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See*, *e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART-00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a protective layer is desirable because, e.g., it prevents corrosion of the foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*wherein the protective layer comprises at least one of chromate, benzotriazole and a silane compound*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), ), Griesi (A23), Suzuki (A21), or any other reference or system disclosing this limitation—with any one of the references disclosing a current collector for a secondary battery having a protective layer comprising at least one of chromate, benzotriazole, and a silane compound—e.g., Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), ), Griesi (A23), Suzuki (A21), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) a current collector for a secondary battery having a protective layer comprising at least one of chromate, benzotriazole,

and a silane compound. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART-00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a protective layer comprising one of the claimed elements is desirable because, e.g., those elements are known to assist in preventing corrosion of the foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil*

Defendants incorporate by reference the disclosures and combinations presented above in Claims 1 and 5. Further, a POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi

(A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing a current collector for a secondary battery having a protective layer formed on the first and second surfaces of the electrolytic copper foil—e.g., Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Tani (A20), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses a current collector for a secondary battery having a protective layer formed on the first and second surfaces of the electrolytic copper foil. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART-00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a protective layer is desirable because it would, e.g., prevent corrosion of the foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*Additional Combinations*

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Patents. For example, and without limitation, the Asserted Claims of the '090 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

| **Patent No. or Title (Primary Inventor/Author)** | **In Combination with One or More of: (Patent No. or Title (Primary Inventor/Author))** |
|---|---|
| Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Kim 301 (A22), and Griesi (A23), and Tani (A20), and any of the prior art systems listed in Table 3-A (A24). | Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 887 (A12), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), Kim 301 (A22), Griesi (A23), any of the prior art systems listed in Table 3-A (A24), secondary references (Appx B), and/or the knowledge of those skilled in the art. |

(iii) '689 Patent:

*[1] An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising:*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a first surface and a second surface opposite the first surface—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) discloses an electrolytic copper foil having a first surface and a second surface opposite the first surface. *See* A1-A23 at [1a] in Appx. A.

*a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil including a matte surface facing the first surface and a shiny surface facing the second surface—e.g., Cheng (A1), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil including a matte surface facing the first surface and a shiny surface facing the second surface. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See*, *e.g.*, Wolski, PRIOR_ART-00002283.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that by employing known techniques to manufacture electrolytic copper foil, i.e., an electrolytic drum, a POSITA would yield the predictable result of manufacturing an electrolytic copper foil with a shiny surface—the side that comes in contact with the drum—and a matte surface opposite the shiny surface. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a first protective layer on the matte surface of the copper layer*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a first protective layer on the matte surface of the copper layer—e.g., Ezura (A4), Hirose

(A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil having a first protective layer on the matte surface of the copper layer. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART_00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a

protective layer is desirable because it would, e.g., prevent corrosion of the foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a second protective layer on the shiny surface of the copper layer*,

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a second protective layer on the shiny surface of the copper layer—e.g., Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil having a second protective layer on the shiny surface of the copper layer. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim

element. *See, e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART-00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a protective layer is desirable because it would, e.g., prevent corrosion of the foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

> *wherein a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30° C. to 190° C. at a speed of 5° C./min, ranges from 16 to 22 μm/(m-° C.)*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein a coefficient of thermal expansion of the electrolytic copper foil, which is measured

using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.)—e.g., Ezura (A4), Hirose (A7),Otsuka 006 (A16), Suzuki (A21), Saito (A17), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7),Otsuka 006 (A16), Suzuki (A21), Saito (A17), Tani (A20) discloses an electrolytic copper foil wherein a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.). *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Khabiti, PRIOR_ART-00001393.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a thermal expansion coefficient within the claimed range is desirable because it would, e.g., reflect a copper foil that could adequately respond to the temperature changes required for use in a lithium ion battery. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a tensile strength of 21 to 36 kgf/mm2 after a heat treatment at a temperature of 190º C for 1 hour—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura

(A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a tensile strength of 21 to 36 kgf/mm2 after a heat treatment at a temperature of 190º C for 1 hour. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Bennett, PRIOR_ART-00000126; Matsuda, PRIOR_ART-00001544.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a tensile strength within the claimed range following the requisite 1 hour of heat treatment would be desirable because it would, e.g., improve its ability to conduct currents. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a weight deviation of the electrolytic copper foil is 5% or less*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara

(A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a weight deviation of 5% or less—e.g., Kim 541 (A10), Lai (A13), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Kim 541 (A10), Lai (A13), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a weight deviation of 5% or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Kubo, PRIOR_ART-00001459.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a weight deviation less than 5% is desirable because a POSITA would be motivated to obtain a uniform copper foil and prevent breakage and fractures. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92,*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a peak count (Pc) of each of the first and second surfaces ranging from 3 to 92—e.g., Suzuki (A21), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Griesi (A23), Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Griesi (A23), Suzuki (A21) discloses an electrolytic copper foil having a peak count (Pc) of each of the first and second surfaces ranging from 3 to 92. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing

electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Yacavone, PRIOR_ART-00002292.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil with both surfaces having a Pc between 3 and 92 would be desirable because, e.g., the copper foil would have a high enough Pc for adhesion but low enough surface roughness to maintain uniformity. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Griesi (A23), Suzuki (A21), and Tani (A20), or any other reference or system

disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a surface roughness (Rz) of 3.5 μm or less—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil having a surface roughness (Rz) of 3.5 μm or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. See, e.g., Fabian, PRIOR_ART-00000326.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to

a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having its first and second surfaces have a surface roughness Rz of 3.5 μm or less would be desirable because it would, e.g., result in a smooth, uniform copper foil that increases the battery life cycle. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having an elongation of 3% or more at room temperature—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of

these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21) discloses an electrolytic copper foil having an elongation of 3% or more at room temperature. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Oguro, PRIOR_ART-00001606.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having an elongation equal or greater than 3% at room temperature would be desirable because it would, e.g., allow the foil to expand and contract with the battery. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound*

Defendants incorporate by reference the disclosures and combinations presented above in

Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound—e.g., Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20) discloses an electrolytic copper foil wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Toshio, PRIOR_ART-00002083; PRIOR_ART-00002138.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a first and second protective layer comprising at least one of the claimed elements would be desirable because the elements are known to prevent corrosion, and a POSITA would be motivated to apply protective layers to prevent the copper foil from corroding. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a thickness of 4 to 30 μm—e.g., Cheng (A1),Ezura (A4), Hirose (A7), Kato

(A9), Iwama (A8), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1),Ezura (A4), Hirose (A7), Kato (A9), Iwama (A8), Kim 541 (A10), Lai (A13), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a thickness of 4 to 30 μm. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Nishimoto, PRIOR_ART-00001595.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a thickness between 4 and 30 μm would be desirable because such a copper foil would, e.g., be thick enough to avoid breakage without resulting in a thick and heavy battery. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion of 17.3 to 22 μm/(m-° C.)*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a coefficient of thermal expansion of 17.3 to 22 μm/(m-° C.)—e.g., Ezura (A4), Hirose (A7), Iwama (A8), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Griesi (A23), and Tani (A20) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Iwama (A8), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a coefficient of thermal expansion of 17.3 to 22 μm/(m-° C.). *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been

motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Khabiti, PRIOR_ART-00001393.

The references share commonalities in terms of their general subject matter, such as copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an electrolytic copper foil having a thermal expansion coefficient within the claimed range would be desirable because the copper foil would, e.g., be able to expand and contract within the lithium ion battery as needed. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*Additional Combinations*

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Patents. For example, and without limitation, the Asserted Claims of the '689 Patent would have been obvious to one of

ordinary skill in the art in view of the following combinations:

| Patent No. or Title (Primary Inventor/Author) | In Combination with One or More of: (Patent No. or Title (Primary Inventor/Author)) |
|---|---|
| Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Griesi (A23), and any of the prior art systems listed in Table 3-A (A24) | Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Griesi (A23), and any of the prior art systems listed in Table 3-A (A24), secondary references (Appx B), and/or the knowledge of those skilled in the art |

(iv) '706 Patent:

*[1] An electrolytic copper foil having a first surface and a second surface,*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a first surface and a second surface—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20),

Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), discloses an electrolytic copper foil having a first surface and a second surface. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Wolski, PRIOR_ART-00002283.

*a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32, TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a texture coefficient of (220) plane of 0.4 to 1.32—e.g., Cheng

(A1), Hirose (A7), Kim 541 (A10), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Hirose (A7), Kim 541 (A10), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21) discloses an electrolytic copper foil having a texture coefficient of (220) plane of 0.4 to 1.32. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Yang, PRIOR_ART-00000148.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the crystal structure that is reflected by a texture coefficient within the claim range positively affects adhesion and other mechanical properties of the electrolytic copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a difference (|Δ(Rz/Ra)|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a difference (|Δ(Rz/Ra)|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil of less than 2.42—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Lee (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Iwama (A8), Lee (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), discloses an electrolytic copper foil having a difference (|Δ(Rz/Ra)|) between Rz/Ra at the first surface of the electrolytic copper foil and

Rz/Ra at the second surface of the electrolytic copper foil of less than 2.42. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Marshall, PRIOR_ART-00001538.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a $|\Delta(Rz/Ra)|$ within the claim range positively affects adhesion and other mechanical properties, and prevents breaking and fracturing. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*a difference ($|\Delta PD|$) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai

(A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a difference (|ΔPD|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil of 96 ea or less—e.g., Suzuki (A21), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Suzuki (A21), Kim 301 (A22), and Griesi (A23) discloses an electrolytic copper foil having a difference (|ΔPD|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil of 96 ea or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, ASME B46.1-2009, SKN-0006603.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged

invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a |ΔPD| within the claim range positively affects adhesion and other mechanical properties, and prevents breaking and fracturing. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[2] The electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0—e.g., Iwama (A8), Lee 980 (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21),

Tani (A20), Kim 301 (A22), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Iwama (A8), Lee 980 (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), discloses an electrolytic copper foil wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Wolski, PRIOR_ART-00002283.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an Rz/Ra within the claim range positively affects adhesion and other mechanical properties, and prevents breaking and fracturing. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8*

Defendants incorporate by reference the disclosures and combinations presented above in

Claims 1 and 2. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8—e.g., Hirose (A7), Iwama (A8), Lee 980 (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7), Iwama (A8), Lee 980 (A14), Saito (A17), Suzuki (A21), Kim 301 (A22), Griesi (A23), discloses an electrolytic copper foil wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Wolski, PRIOR_ART-00002283.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well

as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an Rz/Ra within the claim range positively affects adhesion and other mechanical properties, and prevents breaking and fracturing. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2—e.g., Cheng (A1), Ezura (A4), Hirose (A7), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20), Kim 301 (A22), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi

(A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Ezura (A4), Hirose (A7), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20), Kim 301 (A22), discloses an electrolytic copper foil having a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Matsuda.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a tensile strength within the claim range was commonly known in the industry for decades and positively affects adhesion and other

mechanical properties. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[5] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more.*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23) or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having an elongation, measured at room temperature, of 3% or more — e.g., Cheng (A1), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21) discloses an electrolytic copper foil having an elongation, measured at room temperature, of 3% or more. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described

in Appx B for this claim element. *See, e.g.*, Oguro, PRIOR_ART-00001606.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that an elongation within the claim range positively affects a copper foil's ability to withstand stress and other mechanical properties. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less.*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a lateral weight deviation of 5% or less—e.g., Kim 541 (A10), Lai (A13), Otsuka 944

(A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), Tani (A20), Kim 301 (A22), and Griesi (A23) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Kim 541 (A10), Lai (A13), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), Tani (A20) discloses an electrolytic copper foil having a lateral weight deviation of 5% or less. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Kohiki, PRIOR_ART-00001440.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that a weight deviation within the claim range positively affects uniformity, wrinkles, and other defects. Further explanation of a POSITA's

motivations and understanding can be found in Appx B for this limitation.

*Additional Combinations*

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Patents. For example, and without limitation, the Asserted Claims of the '706 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

| **Patent No. or Title (Primary Inventor/Author)** | **In Combination with One or More of: (Patent No. or Title (Primary Inventor/Author))** |
|---|---|
| Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Kim 301 (A22), and Griesi (A23), and any of the prior art systems listed in Table 3-A (A24) | Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Kim 301 (A22), and Griesi (A23), and any of the prior art systems listed in Table 3-A (A24), secondary references (Appx B), and/or the knowledge of those skilled in the art |

(v) '014 Patent:

*[1] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai

(A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Suzuki (A21), and Tani (A20), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a first surface and a second surface—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tan (A20), Suzuki (A21), and Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), discloses an electrolytic copper foil a first and second surface. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Wolski, PRIOR_ART-00002283.

*a first protective layer at the first surface; a second protective layer at the second surface a copper film disposed between the first and second protective layers*

A POSITA would have had reason to combine references disclosing an electrolytic

copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having protective layers at the first surface and second surface—e.g., Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Tani (A20), Suzuki (A21), and Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kato (A9), Kim 541 (A10), Lee (A14), Suzuki (A21), Tani (A20), Griesi (A23), discloses an electrolytic copper foil having protective layers at the first surface and second surface. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Hua, PRIOR_ART-00000276.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged

invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that protective layers on both sides of the copper foil prevent corrosion of the copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

> *binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer).*

A POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil having a binding coefficient at the first surface or the second surface of 1.5 to 9.4—e.g., Hirose (A7), Suzuki (A21), Griesi (A23), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose

(A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Hirose (A7),Suzuki (A21), Griesi (A23), discloses an electrolytic copper foil having a binding coefficient at the first surface or the second surface of 1.5 to 9.4. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the binding coefficient within the claim range positively affects adhesion, breakage, and other mechanical properties of the electrolytic copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

> *[2] The electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a*

*texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), or any other reference or system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein an X-ray diffraction pattern, measured at the first surface or the second surface, shows a texture coefficient of a (220) plane of 0.49 to 1.28—e.g., Cheng (A1), Hirose (A7), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Cheng (A1), Hirose (A7), Lee (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21) discloses an electrolytic copper foil wherein an X-ray diffraction pattern, measured at the first surface or the second surface, shows a texture coefficient of a (220) plane of 0.49 to 1.28. *See* A1-A23 at [1a] in Appx. A. Additionally, a

POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element.

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the crystal structure that is reflected by a texture coefficient within the claim range positively affects adhesion and other mechanical properties of the electrolytic copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*[4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature*

Defendants incorporate by reference the disclosures and combinations presented above in Claim 1. Further, POSITA would have had reason to combine references disclosing an electrolytic copper foil—e.g., Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23), or any other reference or

system disclosing this limitation—with any one of the references disclosing an electrolytic copper foil wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature—e.g., Ezura (A4), Hirose (A7), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21) or any other reference or system disclosing this limitation. Each of Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), Tani (A20), Suzuki (A21), and Griesi (A23) concerns electrolytic copper foils. *See* A1-A23 at [1a] in Appx. A. Indeed, such compositions were conventional as of the time of these references. Each of Ezura (A4), Hirose (A7), Kim 541 (A10), Lee (A14), Saito (A17), Suzuki (A21) discloses an electrolytic copper foil wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. *See* A1-A23 at [1a] in Appx. A. Additionally, a POSITA would have been motivated to combine the above references disclosing electrolytic copper foil for current collection and retention with any one of the secondary references cited and described in Appx B for this claim element. *See, e.g.*, Kobelco (PRIOR-ART_ 00002610).

The references share commonalities in terms of their general subject matter, such as electrolytic copper foils for use in lithium ion secondary batteries or printed circuit boards, as well as the types of manufacturing processes, products and/or approaches that they describe. Further, they are all directed to features within the same field and a POSITA at the time of the alleged invention would have been motivated to look to these teachings in the field and combine any of these known technologies in the interest of yielding improved electrolytic copper foils useful for lithium batteries. Additionally, because such teachings are merely the application of known

techniques to a known structure to yield predictable results, a POSITA would have been motivated to combine these references.

Moreover, a POSITA would understand that the yield strength within the claim range prevent the generation of cracks, undue stress, and deformation of the copper foil. Further explanation of a POSITA's motivations and understanding can be found in Appx B for this limitation.

*Additional Combinations*

For at least the reasons described above, it would have been obvious to one of ordinary skill in the art to combine each prior art reference listed in Appendix A with any other reference or references listed in Appendix A and Appendix B along with the knowledge of one of ordinary skill in the art to arrive at the inventions claims in the Asserted Patents. For example, and without limitation, the Asserted Claims of the '014 Patent would have been obvious to one of ordinary skill in the art in view of the following combinations:

| **Patent No. or Title (Primary Inventor/Author)** | **In Combination with One or More of: (Patent No. or Title (Primary Inventor/Author))** |
|---|---|
| Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Griesi (A23), and any of the prior art systems listed in Table 3-A (A24) | Cheng (A1), Chou (A2), Dobashi (A3), Ezura (A4), Hanafusa (A5), Hara (A6), Hirose (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Kim 761 (A11), Kim 887 (A12), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Sano (A18), Shinozaki (A19), and Tani (A20), Suzuki (A21), Greisi (A23), Table 3-A (A24), secondary references (Appx B), and/or the knowledge of those skilled in the art |

**2. Lack of Secondary Indicia of Nonobviousness**

The Asserted Claims are further rendered obvious in light of the lack of any evidence of secondary considerations of nonobviousness. Plaintiff bears the burden with respect to any such secondary considerations, and it has not satisfied that burden to date. Moreover, for any secondary consideration to be relevant, Plaintiff must establish a nexus between the secondary consideration and the claimed inventions. *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006). Plaintiff has not provided any evidence of any secondary considerations, much less any nexus between such secondary considerations and the claimed inventions of the Asserted Patents. Should Plaintiff identify such alleged secondary considerations, Defendants will respond.

In the meantime, Defendants provides the following:

- **The alleged invention's commercial success:** There is no evidence that the allegedly novel copper foils claimed in the Asserted Patents could possibly lead to commercial success of products, especially the electrolytic copper foils Plaintiff has accused in this case.
- **Long felt but unresolved needs / recognition of an unaddressed problem:** No such long felt and unresolved need or unaddressed problem existed. To the contrary, the prior art cited in Appendix A and Appendix B demonstrates that numerous others had already recognized and solved the needs purportedly addressed by the Asserted Patents.
- **Unexpected results:** No evidence of any such unexpected results or skepticism by experts is known. To the contrary, the alleged inventions claimed in the Asserted Patents are entirely preempted by the work of others and/or represent, at best, the foreseeable results of routine experimentation or optimization given the state of the art as shown by the prior art cited in Exhibits A1-A24.

- **The failure of others:** No evidence of any such failure is known. To the contrary, the prior art cited in Appendix A and Appendix B demonstrates that numerous others had already succeeded at the same endeavor purportedly addressed by the Asserted Patents.
- **Praise by others:** No evidence of any such praise is known.
- **Teaching away by others:** No evidence of any such teaching is known. To the contrary, the prior art cited in Appendix A and Appendix B demonstrates that numerous others had already taught *toward* the purported inventions recited in the Asserted Claims.
- **Copying of the alleged invention by competitors:** No evidence of any such copying is known. *See Amazon.com, Inc. v. Barnesandnoble.com, Inc.*, 239 F.3d 1343, 1366 (Fed. Cir. 2001) (allegedly copied feature must be an embodiment of the patented claims).

## IV. P.R. 3-3(c): Claim Charts

Pursuant to Rule 3-3(c), Defendants identify invalidity claim charts identifying disclosures in the references identified in Sections II-III *supra* as to the Asserted Claims of the Asserted Patents are provided in attached Appendix A and Appendix B.

The citations to the prior art provided in these contentions are intended to be exemplary, not exhaustive. Defendants have endeavored to cite to the most relevant portions of the identified prior art. Where Defendants identify a particular figure in a prior art reference, the identification should be understood to encompass the caption and description of the figure, as well as any text relating to the figure in addition to the figure itself. Similarly, where an identified portion of text refers to a figure, embodiment, or other material, the identification should be understood to include

the referenced figure, embodiment, or other material as well. Consistent with P.R. 3-3(c), Defendants' citations to specific statements, figures, or disclosures in a prior art reference are sufficient to put Plaintiff on notice where each element of each Asserted Claim is found in the prior art. However, it should be recognized that a person of ordinary skill in the art would generally read a prior art reference as a whole and in the context of other publications, literature, and general knowledge in the field. To understand and interpret any specific statement or disclosure in a prior art reference, a person of ordinary skill in the art would rely upon other information including other publications and general scientific or engineering knowledge. Defendants therefore reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony to provide context and to aid understanding and interpretation of the identified portions. Defendants further reserve the right to use any and all portions of the publication, related publications, commercial embodiments of the publication, and other evidence that is discovered in these lawsuits to demonstrate and/or evidence the components, functionality, and capabilities of the devices and systems disclosed in the references charted. Defendants also reserve the right to rely upon treatises, published industry standards and similar documents to demonstrate the knowledge of one of ordinary skill in the relevant art. Other portions of the identified prior art may additionally disclose, either expressly or inherently, and/or render obvious one or more elements or limitations of the Asserted Claims.

Defendants' reference to a particular device, system, copper foil or product in the claim charts should be interpreted as a reference to the product itself and any corresponding patents, publications, or product literature cited in the claim charts that relates to the cited device, system, copper foil or product. In addition, Defendants may rely on other documents or things that have not yet been located to support its contentions regarding such prior art device, system, copper foil

or product that are referenced in the charts.

Defendants also reserve the right to rely upon other portions of the prior art references, other publications, and the testimony of experts to establish that the alleged inventions would have been obvious to a person of ordinary skill in the art, including the basis of modifying or combining certain cited references. To the extent any limitation is deemed not to be exactly met by an item of prior art, then any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art. To the extent that an element of an Asserted Claim is not anticipated, the claim is rendered obvious by combination with one or more other identified prior art references.

Throughout the invalidity claim charts Defendants provide exemplary citations showing where references disclose subject matter recited in preambles of the Asserted Claims, regardless of whether the preambles limit the claims. Defendants reserve the right to argue that the preambles are or are not limitations. Further, where an entry in a claim chart corresponding to a given limitation refers back to the discussion of another claim, the entry incorporates all evidence cited for the other claim.

As noted above, the Asserted Claims have not yet been construed. Additional portions of the references may become relevant after claim construction. Further, to the extent that any claim term is governed by 35 U.S.C. § 112 ¶ 6, the claim charts identify, by the citations provided, the structure(s), act(s), or material(s) in each reference performing the claimed function for each limitation of the Asserted Claims. Plaintiffs' claim construction positions, expert analysis and testimony, and additional discovery could all inform which portions of the references disclose a limitation, including under 35 U.S.C. § 112 ¶ 6, and whether any particular limitation is governed

by 35 U.S.C. § 112 ¶ 6. Defendants' contentions are based on the information presently available, and Defendants reserve all rights to provide their claim construction positions in accordance with the Docket Control Order in this case.

## V. P.R. 3-3(d): 35 U.S.C. § 112 (Indefiniteness, Written Description, Enablement)

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the Asserted Patents based on indefiniteness, lack of written description and lack of enablement under 35 U.S.C. § 112. Defendants' contentions shall not be construed as an admission that any claim construction advanced by Defendants in this case is in any way inconsistent, flawed, or erroneous. Nor should these contentions prevent Defendants from advancing claim construction and/or non-infringement positions in lieu of, or in addition to, invalidity positions. Further, these contentions shall not be construed as an admission of or acquiescence to Plaintiff's purported construction of the claim language or of other positions advanced by Plaintiff during the course of this litigation. Defendants' invalidity contentions under 35 U.S.C. § 112 may depend, in part, on the Court's claim construction, as well as Plaintiff's alleged scope of the Asserted Claims. Consequently, Defendants only identify the issues under 35 U.S.C. § 112 of which they are presently aware.

### A. The Asserted Claims Are Invalid for Indefiniteness

Pursuant to Rule 3-3(d), Defendants hereby identify grounds of invalidity for the Asserted Patents based on indefiniteness under 35 U.S.C. § 112, second paragraph. "[T]he second paragraph of § 112 contains two requirements: first, the claim must set forth what the applicant regards as his invention, and second, it must do so with sufficient particularity and distinctness, *i.e.*, the claim must be sufficiently definite." *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1348 (Fed. Cir. 2002) (internal quotation marks and alteration omitted). "Where it would be apparent to one of skill in the art, based on the specification, that the invention set forth in a claim is not what the patentee regarded as his invention," the claim is "invalid under § 112,

paragraph 2." *Id.* at 1349. Independently, under § 112, ¶ 2, "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014).

The Asserted Claims are invalid for indefiniteness because they fail to set forth with sufficient particularity what the applicant regards as their invention, *Allen Eng'g*, 299 F.3d at 1348, and they, when "read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus*, 572 U.S. at 901.

A general issue common to many of the Asserted Claims, and discussed further below, is that they recite a variety of physical characteristics for copper foil without conveying to one of skill in the art with reasonable certainty the procedure for measuring those characteristics and, further, the application of different procedures to measure those characteristics may result in different measurements following inside or inside of the scope of the claims. The Federal Circuit has held that a claim is indefinite where the patent specification does not sufficiently describe how to measure the claimed measurements. *See, e.g.*, *Teva Pharm. USA v. Sandoz, Inc.*, 789 F.3d 1335, 1345 (Fed. Cir. 2015) (finding "molecular weight" indefinite because the intrinsic record did not tell persons of skill in the art which of three possible measures for molecular weight to use); *Dow Chem. Co. v. Nova Chemicals Corp. (Canada)*, 803 F.3d 620, 633–34 (Fed. Cir. 2015) (holding indefinite claims requiring a particular slope of strain hardening where there were multiple methods of calculating the slope of strain hardening, each of which resulted in a different value, and the patent did not discuss any of the methods and there was no evidence as to how a person of skill in the art would have calculated slope).

### 1. ’541 Patent

The ’541 Patent Asserted Claims are invalid under 35 U.S.C. § 112 ¶ 2 for indefiniteness because the claims, “read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). For example, a person of ordinary skill in the art would not be able to determine the scope of the alleged invention because at least the following terms are indefinite.

#### (a) (Claim 1) Texture Coefficient Limitation

Claim 1 of the ’541 Patent is indefinite with respect to the limitation requiring “in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, wherein the texture coefficient satisfies the following equation:

$$TC(hkl) \geq \frac{\frac{I(hkl)}{I_0(hkl)}}{\frac{1}{n}\Sigma\frac{I(hkl)}{I_0(hkl)}}$$

wherein I(hkl) represents a measured diffraction intensity with respect to a (hkl) surface, and $I_0$(hkl) represents a standard diffraction intensity of ASTM (American Society of Testing Materials) standard powder-shaped diffraction data” (referred to as the “Texture Coefficient

Limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring diffraction intensities used to calculate texture coefficients and ratios of texture coefficients, and different methods of measurement would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). For example, the claim and specification fail to specify a variety of parameters relevant to XRD testing including the (1) use of a variable or fixed slit geometry; (2) size of the constant slit opening for the fixed geometry or the size of the irradiated area with the variable slit geometry; (3) alignment of the sample—e.g., longitudinal or transverse—with respect to the incident beam; (4) choice of which face of the sample to be examined; (5) technique for fitting the background intensity; (6) choice of whether to smooth or filter the raw data; (7) application of a thin film correction; and (8) the x-ray characteristics including light source, the incident angle, the accelerating energy, the irradiated dosage, and irradiation angle.

In *Sandvik* (W.D. Pa. July 24, 2012), the court found a similar texture coefficient limitation indefinite for reasons that similarly apply to the Texture Coefficient Limitation of the '541 Patent. *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012); Affidavit of William Edward Mayo, Ph.D. in Support of Defendant Kennemetal Inc.'s Responsive Claim Construction Brief, *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, DKt. No. 109 (Nov. 22, 2010). The court found "Measured Intensity of the (hkl) Reflection" indefinite because "[t]est data demonstrates that the variation in the calculated value of TC(012) as a result of applying numerous collection and analytical factors that

confronted one of skill in the art as of December 1992 made a meaningful difference in that the resulting TC(012) values of the same Sandvik GC415, GC3015, and GC4215 samples fell both within and without the greater than 1.3 (and/or 1.5) texture coefficient value required by the claims of the '625 Patent to infringe." *Sandvik*, 2012 WL 3028028, at *9. The defendants' expert, Dr. Mayo, further described testing data and analytical factors in his accompanying affidavit and summarized the measured impact of those factors in the table below:

**Table 14 Summary of Major Influences on Variability in TC(012)**

| Decision Point | Choice | Range of Variability in TC (012) | Conditions |
|---|---|---|---|
| Experimental | fixed slit instead of variable | 5% to 10% | Greater if beam spills over the sample edge |
| Experimental | large slit opening instead of smaller slit opening | 10% to 30% | Greater if beam spills over the sample edge |
| Experimental | use transverse alignment instead of longitudinal | 10% to 20% | Greater if beam spills over the sample edge |
| Experimental | surface to surface variability | 5% | Random choice |
| Analytical | subtract $K\alpha_2$ artifact | 9% | |
| Analytical | use raw data instead of smoothed or filtered data | 8% | |
| Analytical | use peak intensity instead of area intensity | 3% | |
| Analytical | include the thin film correction | 25% to 36% | |
| Computational | choice of reference intensity data set | 30% to 40% | |

Here, as in *Sandvik*, the application of different settings and parameters for XRD data collection and analysis would result in meaningful differences in the calculation of texture coefficients and ratios of texture coefficients, rendering the claim indefinite. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed.

Cir. 2015); *Dow Chem.*, 803 F.3d at 633–34 (Fed. Cir. 2015).[3]

The Texture Coefficient Limitation is also indefinite if $I_0$(hkl) is not construed to require the JCPDS (Joint Committee for Powder Diffraction Studies) card for standard powder specimens (04-0836) of copper (Cu). *See, e.g.*, *Sandvik*, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012) (holding that "'Io(hkl) = standard intensity of the ASTM standard powder pattern diffraction data,' is not sufficiently precise to permit a potential infringer to determine the bounds of the claims of the '625 Patent"). During prosecution, the applicant for the '541 Patent filed an Information Disclosure Statement identifying an "JCPDS (Joint Committee for Powder Diffraction Studies) card for standard powder specimens (04-0836) of copper (Cu) used in the subject invention." SKN0001767 at -1855. Further, the patentee distinguished the prior art using values from this JCPDS 04-0836:

[3] Although *Sandvik* concerned α-alumina, the application of different settings and parameters for XRD data collection and analysis would also have a material impact on measured characteristics of copper foils like those required by claim 1 of the '541 Patent.

More specifically, the ratio I(200)/I(111) of *Hirose* can be calculated as follows by using the data of Table 1 of the instant application.

*TC* : *Texture Coeffciient*

$$\frac{(200)ratio}{(111)ratio} = \frac{\frac{TC(200)}{TC(111)+TC(200)+TC(220)}}{\frac{TC(111)}{TC(111)+TC(200)+TC(220)}} = \frac{TC(200)}{TC(111)}$$

$$= \frac{\frac{\frac{I(200)}{I_0(200)}}{\frac{1}{3}\left(\frac{I(111)}{I_0(111)}+\frac{I(200)}{I_0(200)}+\frac{I(220)}{I_0(220)}\right)}}{\frac{\frac{I(111)}{I_0(111)}}{\frac{1}{3}\left(\frac{I(111)}{I_0(111)}+\frac{I(200)}{I_0(200)}+\frac{I(220)}{I_0(220)}\right)}} = \frac{\frac{I(200)}{I_0(200)}}{\frac{I(111)}{I_0(111)}} = \frac{I_0(111)}{I_0(200)} \times \frac{I(200)}{I(111)}$$

$\Rightarrow$ *JCPDS CARD* 04 – 0836 : $I_0(111) = 100,\ I_0(200) = 46$

$$\frac{(200)ratio}{(111)ratio} = \frac{100}{46} \times \frac{I(200)}{I(111)}$$

$$\Rightarrow \quad \frac{I(200)}{I(111)} = 0.46 \times \frac{(200)ratio}{(111)ratio}$$

*See, e.g.*, SKN0001767 at -2303-306. If "I0(hkl) represents a standard diffraction intensity of ASTM. . . standard powder-shaped diffraction data," does not require JCPDS 04-0836, a person of ordinary skill would not know with reasonable certainty which standard diffraction intensity of ASTM to use in the calculation. Further, numerous standard-powder shaped diffraction data were in existence at the time of the '541 Patent that would result in different calculations of texture coefficients as well as different calculations of ratios of texture coefficients.

The Texture Coefficient Limitation is also indefinite because it requires texture coefficients greater than or equal to certain values, which are then used to calculate different ratios:

$$TC(hkl) \geq \frac{\frac{I(hkl)}{I_0(hkl)}}{\frac{1}{n}\Sigma\frac{I(hkl)}{I_0(hkl)}}$$

A person of ordinary skill in the art would not understand with reasonable certainty how to calculate a ratio of two "greater than or equal" values.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in XRD data collection would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the Texture Coefficient Limitation is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 1) "weight deviation of 3% or less"**

Claim 1 of the '541 Patent is indefinite with respect to the limitation "weight deviation of 3% or less" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring weight deviation, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the weight deviation.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. For example, the specification describes "cutting a copper foil by an area of 5 cm×5 cm to make a test piece, measuring weight of the test piece and converting the weight into a weight of the copper foil per a unit area, cutting the test

piece along a width direction of the copper foil, repeating the above processes to measure weights of copper foils of every test piece, and then calculating a standard deviation":

> The weight deviation of the copper foil should be 3% or less. If the weight deviation exceeds 3%, property deviations occur at the surface of the copper foil, which may increase the number of wrinkles and make properties of the current collector irregular. Here, the weight deviation is obtained by cutting a copper foil by an area of 5 cm×5 cm to make a test piece, measuring weight of the test piece and converting the weight into a weight of the copper foil per a unit area, cutting the test piece along a width direction of the copper foil, repeating the above processes to measure weights of copper foils of every test piece, and then calculating a standard deviation. At this time, the copper foil is preferably an electrodeposited copper foil that is surface-chromated for the prevention of corrosion.

*See, e.g.*, '541 Patent at 4:26-39. However, the specification is not reasonably certain as to the numerous aspects of this test including, for example, the direction to cut the 5 cm x 5 cm sample, the number of test pieces to cut and measure, or how to cut the test pieces (e.g., the required precision of the size of the test pieces).

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring weight deviation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "weight deviation of 3% or less" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(c) (Claim 1) "tensile strength of 30 to 40 kgf/mm$^2$"**

Claim 1 of the '541 Patent is indefinite with respect to the limitation "tensile strength of 30 to 40 kgf/mm$^2$" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring tensile strength, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the tensile strength.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The majority of the specification's disclosures pertain to values of the tensile strength without explaining how those values were obtained. *See, e.g.*, '541 Patent at Abstract, 2:5-10, 2:27-28, 3:3-7, 4:40-45, 4:46-51, 5:17-21, 5:30-35. In addition, the specification's disclosure that "[i]n the table 1, the tensile strength was measured by using a UTM (Universal Testing Machine), and at this time the gauge length was set to 5 cm," *id.* at 4:50-52, would not render the scope of the term reasonably certain. The specification does not explain, for example, how the sample should be tested using a UTM (apart from the disclosure that "gauge length was set to 5 cm"), the distance between grips, measurement speed, force, temperature, or whether tensile strength is measured at a constant strain or a constant force, which may affect the measurement results.

For example, with respect to temperature, at the time of the '541 Patent, copper foils were conventionally subjected to tensile strength tests under both ordinary temperature and high temperature and a POSITA would not have known with reasonable certainty which test was contemplated by claim 1. For example, Kumagai, (U.S. 2006/0166032), describes "Ordinary temperature elongation, ordinary temperature tensile strength, high temperature elongation, and high temperature tensile strength." PRIOR_ART-00002204 at [0054]. *See also, e.g.*, *id.* at [0010], [0012], [0015], [0016], [0017], [0038], [0051], [0055]-[0060]. The results of ordinary and high

temperature measurements differ, as shown by way of example in Table 2-1 below:

TABLE 2-1

| | Additive | Additive | Additive A (ppm) | | | | | | Rz | Ordinary temperature elongation | Ordinary temperature tensile strength | High temperature elongation | High temperature tensile strength |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B1 (ppm) | B2 (ppm) | b | a1 | a2 | a3 | a4 | a5 | (μm) | (%) | (kgf/mm$^2$) | (%) | (kgf/mm$^2$) |
| Example 1 | 50 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0.93 | 6.85 | 31.0 | 16.5 | 20.6 |
| Example 2 | 50 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 1.17 | 10.34 | 34.7 | 18.5 | 20.1 |
| Example 3 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 1.02 | 5.32 | 76.5 | 13.3 | 20.1 |
| Example 4 | 50 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 1.45 | 3.00 | 48.7 | 17.6 | 20.3 |
| Example 5 | 50 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 1.23 | 8.42 | 35.4 | 11.8 | 20.0 |
| Example 6 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 1.78 | 8.59 | 33.6 | 8.8 | 20.3 |
| Example 7 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 1.10 | 6.55 | 33.0 | 15.3 | 21.0 |
| Example 8 | 0 | 50 | 0 | 50 | 0 | 0 | 0 | 0 | 1.23 | 9.55 | 33.1 | 17.9 | 21.0 |
| Example 9 | 0 | 50 | 0 | 0 | 50 | 0 | 0 | 0 | 1.11 | 5.35 | 45.6 | 15.6 | 21.4 |
| Example 10 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 1.51 | 3.10 | 45.0 | 17.6 | 23.0 |
| Example 11 | 0 | 50 | 0 | 0 | 0 | 0 | 50 | 0 | 1.25 | 8.59 | 36.1 | 12.0 | 21.5 |
| Example 12 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 50 | 1.55 | 6.80 | 33.2 | 8.9 | 21.5 |

*Id.* at Table 2-1; *see also, e.g., id.* at Table 2-2, Table 3. Similarly, copper foil specifications conventionally describe "RT" (room temperature) and 180 degrees C with different results:

**Typical average properties**



| BF-Plainstainproof | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEASURED PARAMETERS** | **UNITS** | **PRODUCT GAUGE** | | | | **IPC** | |
| **Nominal Thickness** | **μm<br>oz.** | **9<br>1/4** | **10<br>-** | **12<br>3/8** | **18<br>1/2** | **Specification<br>IPC-4562A** | **Test Method<br>IPC-TM-650** |
| Area Weight (± 5 %) | oz/ft²<br>g/m²<br>g/254 in² | 0.27<br>82<br>13.4 | 0.29<br>90<br>14.7 | 0.34<br>105<br>17.2 | 0.48<br>148<br>24.3 | (a)1.2.5, table 1-1<br>(b)3.4.4<br>(c)4.6.3 | 2.2.12 |
| Drum Side Roughness (Ra) | μm<br>μ.inch | 0.20 - 0.40<br>8 - 16 | | | | 3.5.6 | 2.2.17 |
| Drum Side Roughness (Rz) | μm<br>μ.inch | 1.0 - 3.0<br>39 - 118 | | | | 3.5.6 | 2.2.17 |
| Electrolyte Side Roughness (Rz) | μm<br>μ.inch | 1.5 - 3.0<br>59 - 118 | | | | 3.4.5 | 2.2.17 |
| Tensile Strength Transverse at RT | MPa<br>k.Lb/in² | > 315<br>> 46 | | | | 3.5.1 | 2.4.18 |
| Tensile Strength Transverse at 180 °C | MPa<br>k.Lb/in² | > 180<br>> 26 | | | | 3.5.1 | 2.4.18 |
| Elongation Transverse at RT | % | > 5 | | > 7 | > 12 | 3.5.3 | 2.4.18 |
| Elongation Transverse at 180 °C | % | > 8 | | > 12 | > 15 | 3.5.3 | 2.4.18 |
| Resistivity | Ωg/m² | < 0.171 | | < 0.170 | < 0.166 | 3.8.1.2 | 2.5.14 |
| Purity | % | > 99.8 | | | | 3.8.1.1 | 2.3.15 |

[PRIOR_ART-00002334]. *See also, e.g.*, [PRIOR_ART-00002332]; [PRIOR_ART-00002333].

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring tensile strength would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "tensile strength of 30 to 40 kgf/mm$^2$" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

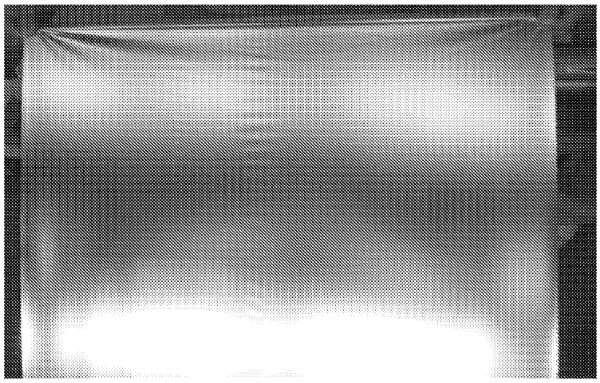
**(d) (Claim 1) "so as to prevent the generation of wrinkles at a surface of the copper foil"**

Claim 1 of the '541 Patent is indefinite with respect to the limitation "so as to prevent the generation of wrinkles at a surface of the copper foil" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

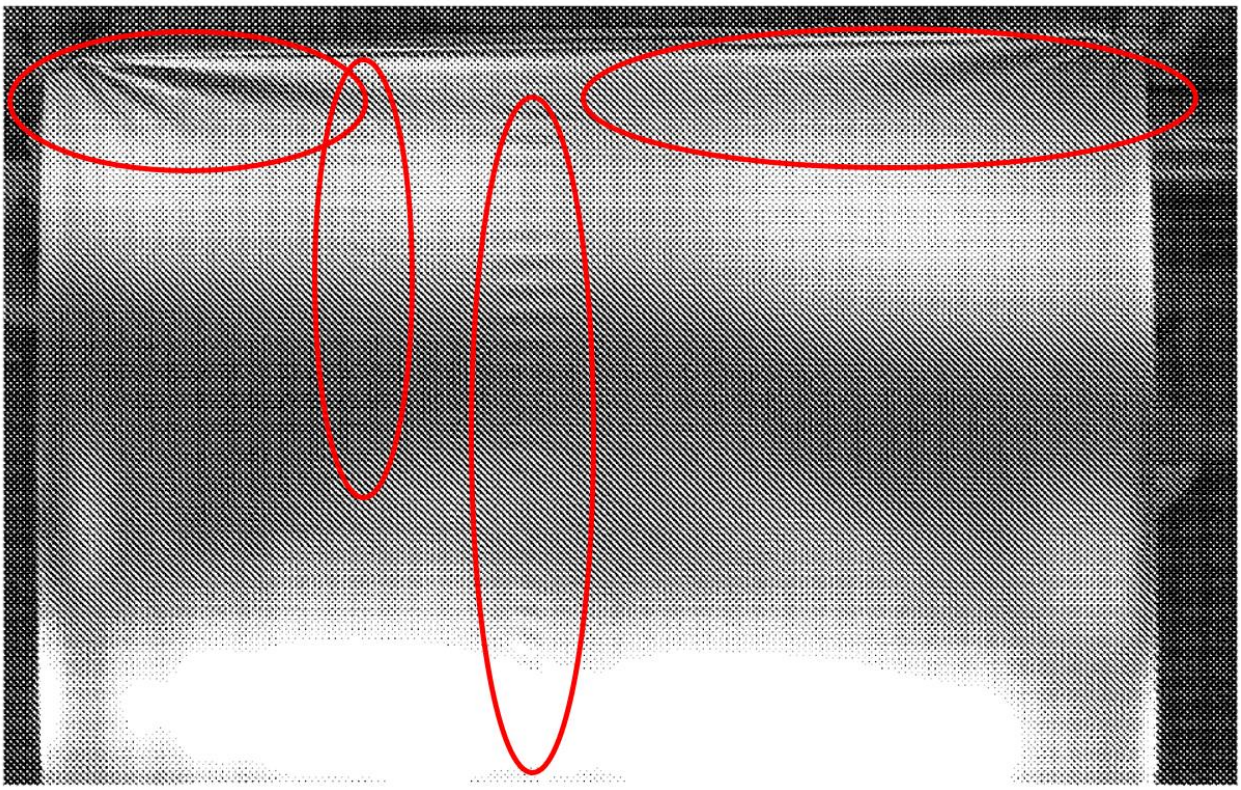
For example, claim 1 is indefinite because a person of ordinary skill would not have known with reasonable certainty what qualifies as "wrinkle" or how to assess whether a wrinkle is present. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015); *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1256 (Fed. Cir. 2008) (holding that "fragile gel" is indefinite due to its ambiguity). Claim 1 does not include any description or objective criteria for determining how to assess whether wrinkles are present.

The specification similarly fails to disclose how to determine whether a wrinkle exists. The specification purports to provide a single illustration of a "wrinkle," particularly in the context of a "conventional" foil in relation to Figure 1:

FIG. 1



*See* '541 Patent 1:58-62 ("In case a wrinkle exists on a surface of a copper foil as shown in FIG. 1, active material is not uniformly coated due to the irregularity of the surface shape, which may cause a short-circuit or separate the active material from the copper foil during a charging or discharging process."), 2:44-46 ("FIG. 1 is a photograph showing that a wrinkle is generated at a conventional copper foil for a current collector of a lithium secondary battery . . ."). However, Figure 1 does not provide a person of ordinary skill with reasonable certainty to assess whether a wrinkle exists for numerous reasons. For example, Figure 1 shows numerous surface characteristics (annotated below) and the patentee did not specify which surface characteristic it considers "a wrinkle":



’541 Patent at Fig. 1 (annotated). As another example, the specification also does not explain the method of assessing whether a wrinkle was present in the copper foil of Figure 1 such as, for example, how a copper foil should be manipulated or processed to test whether wrinkles have been prevented or whether any measurement device or equipment is to be used in assessing whether a wrinkle is present. While Figure 1 appears to show hands holding the upper left and upper right corners of the copper foil, it is unclear whether the bottom of the copper foil is restrained and whether any tension is being applied to the copper foil. As another example, the specification does not include any figures showing the appearance of a copper foil (subject to similar testing conditions as the copper foil of Figure 1 or otherwise) that does ***not*** have a wrinkle. The specification’s single, ambiguous description of a “wrinkle” and its absent description of the manner for assessing the presence of a wrinkle does not provide sufficient guidance such that a person of ordinary skill would be able to assess whether a particular copper foil had a wrinkle.

The specification does not otherwise or elsewhere describe how to assess whether "wrinkles" are present at the surface of a copper foil. It includes numerous uses of the word "wrinkle," and without explaining how to determine whether a wrinkle is present. *See, e.g.*, '541 Patent at 1:17-22, 1:53-2:10, 2:31-36, 2:44-46, 3:3-7, 3:51-5:52, Table 1. The specification's reference the "number of wrinkles" in examples 1 to 7 and comparative examples 1 to 9 of Table 1 similarly do not explain how to determine whether a wrinkle is present.

As another example, "***so as to*** prevent the generation of wrinkles at a surface of the copper foil" is indefinite because its meaning is not reasonably certain.

As another example, "so as to ***prevent the generation*** of wrinkles at a surface of the copper foil" is indefinite because its meaning is not reasonably certain. For example, it is unclear whether this limitation requires that there by zero wrinkles in the disclosed copper foil. As another example, it is unclear what conditions are contemplated to assess whether the "generation" of wrinkles has been prevented.

As another example, "so as to prevent the generation of wrinkles ***at a surface*** of the copper foil" is indefinite because its meaning is not reasonably certain.

Thus, for at least these reasons, the term "so as to prevent the generation of wrinkles at a surface of the copper foil" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(e) (Claim 2) "surface roughness ($R_z$-JIS) of 2 μm or less"**

Claim 2 of the '541 Patent is indefinite with respect to the limitation "surface roughness ($R_z$-JIS) of 2 μm or less" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring surface roughness, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 2 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring surface roughness.

Further, the specification is silent as to how to measure surface roughness. *See, e.g.*, '541 Patent at Abstract, 1:44-52, 2:5-10, 2:24-25, 3: 1-7. The specification discloses using JIS standards to determine "Rz" but does not disclose the standard for "Rz-JIS." *E.g.*, *id.* at 4:20-25. *See also* JIS B 0601 (1994) (using both "Rz" and "Rz-JIS" terminology to describe different measures). Further, the specification fails to describe numerous other aspects of testing such as for example sample preparation, the measurement equipment (e.g., a stylus/contact profilometer or an optical profilometer), settings to be used on the equipment (e.g., for contact profilometers, the stylus tip, pressure and measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things. Moreover, at the time of the '689 Patent, numerous standards were in existence for measuring Rz-JIS including, for example, the 1994 and 2001 versions of JIS B 0601 that may yield different results.

In addition, surface roughness (Rz-JIS) measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078, (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of

very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***.”). A given copper foil sample may have a surface roughness within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the precise location of a sample to be used in assessing surface roughness, leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring surface roughness (Rz-JIS) would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term “surface roughness ($R_z$-JIS) of 2 μm or less” is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(f) (Claim 3) “elongation of 3 to 20%”**

Claim 3 of the ’541 Patent is indefinite with respect to the limitation “elongation of 3 to 20%” because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring elongation, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 3 does not specify, and a person of ordinary skill would not know with

reasonable certainty, the particular method required for measuring elongation.

Further, the specification merely repeats the term "elongation" without providing any description of how to measure elongation. *See, e.g.*, '541 Patent at Abstract, 2:5-10, 2:29, 3:3-7, 4:40-45. The specification fails to disclose, for example, the apparatus used to measure elongation, the standard or parameters used to measure elongation, the manner of sample preparation (e.g., its dimensions) or testing conditions (e.g., temperature). For example, at the time of the '541 Patent, copper foils were conventionally subjected to elongation tests under both ordinary temperature and high temperature and a person of ordinary skill would not have known with reasonable certainty which test was contemplated by claim 3 as discussed with respect to the "tensile strength of 30 to 40 $kgf/mm^2$" limitation in claim 1 of the '541 Patent, the discussion of which is incorporated by reference.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring elongation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "elongation of 3 to 20%" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**2. '090 Patent**

The '090 Patent Asserted Claims are invalid under 35 U.S.C. § 112 ¶ 2 for indefiniteness because the claims, "read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). For example, a

person of ordinary skill in the art would not be able to determine the scope of the alleged invention because at least the following terms are indefinite.

**(a) (Claim 1) "each of the first and second surfaces has a peak count roughness Rpc of 10 to 100, wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at randomly-selected three points, the peak count roughness Rpc of each point is the number of effective peaks which rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks."**

Claim 1 of the '090 Patent is indefinite with respect to the limitation "each of the first and second surfaces has a peak count roughness Rpc of 10 to 100, wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at randomly-selected three points, the peak count roughness Rpc of each point is the number of effective peaks which rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring peak count roughness (Rpc), and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva,* 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1's requirement that peak count roughness Rpc of each surface "is an average of peak count roughness Rpc values measured at randomly-selected three points, the peak count roughness Rpc of each point is the number of effective peaks which rise

above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks," does not provide sufficient guidance to a person of ordinary skill in the art.

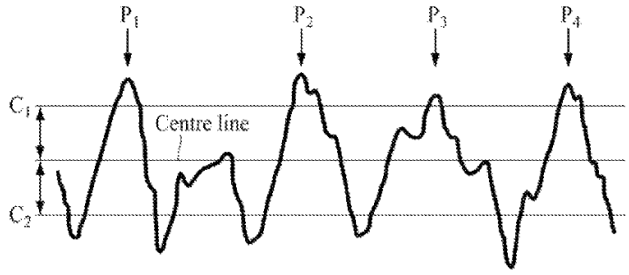
Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *See, e.g.*, '090 Patent at Abstract, 2:18-61, 5:19-64, 6:29-51, 8:1-21 (providing that a "MahrSurf M300 roughness tester available from Mahr companies"), Table 1. The majority of the specification's disclosures pertain to values of the peak count roughness (Rpc) without explaining how those values were obtained. For example, the specification fails to describe numerous other aspects of testing such as for example sample preparation, settings to be used on the equipment (e.g., the stylus tip, pressure and measurement speed), filters to be applied to the data, among other things.

In addition, peak count roughness (Rpc) measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). A given

copper foil sample may have a peak count roughness (Rpc) within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the precise location of a sample to be used in assessing peak count roughness (Rpc), leaving it to the arbitrary discretion of the tester and random chance. Thus, claim 1's requirement for a "random" sample selection—reciting "wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at ***randomly-selected*** three points"—further renders the claim indefinite.

Claim 1 is also indefinite because it requires determining the "surface roughness profile obtained according to steel-iron test schedule (SEP 1940)," referring to a standard that is not cited in the file history of the '090 Patent and does not appear to have been available or, at the very least, readily available. Further, while the specification asserts that "FIG. 2 illustrates a surface roughness profile obtained according to steel-iron test schedule (SEP 1940) specification," '090 Patent at 1:35-37, it does not explain how the surface roughness was obtained, how the centerline was identified, or whether any filters were applied to the data:

FIG. 2




'090 Patent at Fig. 2.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring peak count roughness (Rpc) would result in different values, and that repeat measurements of a

particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "each of the first and second surfaces has a peak count roughness Rpc of 10 to 100, wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at randomly-selected three points, the peak count roughness Rpc of each point is the number of effective peaks which rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 2) "a difference in peak count roughness Rpc between 30 the first and second surfaces is 60 or less"**

Claim 2 of the '090 Patent is indefinite with respect to the limitation "a difference in peak count roughness Rpc between 30 the first and second surfaces is 60 or less" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus,* 572 U.S. at 901 (2014). The limitation is indefinite for at least the same reasons as the peak count roughness (Rpc) limitation of claim 1 discussed above, the discussion of which is incorporated by reference herein.

**(c) (Claim 3) "each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less"**

Claim 3 of the '090 Patent is indefinite with respect to the limitation "each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty

those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring the ten-point mean roughness RzJIS, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 3 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the ten-point mean roughness RzJIS.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. While the specification repeatedly refers to "RzJIS," it does not identify any particular standard to use to determine this measurement. *See, e.g.*, '090 Patent at 4:28-33, 4:56-5:18, 6:29-51. Further, the specification fails to describe numerous other aspects of testing such as for example sample preparation, the measurement equipment (e.g., a stylus/contact profilometer or an optical profilometer), settings to be used on the equipment (e.g., for contact profilometers, the stylus tip, pressure and measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things. In addition, at the time of the '090 Patent, numerous standards were in existence to measure RzJIS that may have yielded different results, including for example 1994, 2001 and 2013 versions of JIS B 0601.

In addition, ten-point mean roughness (RzJIS) measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample

falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). A given copper foil sample may have a ten-point mean roughness (RzJIS) within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the precise location of a sample to be used in assessing the ten-point mean roughness (RzJIS), leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring ten-point mean roughness (RzJIS) would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(d) (Claim 4) "tensile strength of 30 to 60 kgf/mm$^2$"**

Claim 4 of the '090 Patent is indefinite with respect to the limitation "tensile strength of 30 to 60 kgf/mm$^2$" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring tensile strength, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 4 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring tensile strength.

Further, the specification is silent as to how to measure tensile strength and includes only a single, brief reference to it. '090 Patent at 4:13-14 (describing "a tensile strength of 30 to 60 $kgf/mm^2$"). The specification does not disclose, for example, sample preparation, the distance between grips, measurement speed, force, temperature, or whether tensile strength is measured at a constant strain or a constant force, which may affect the measurement results. For example, at the time of the '090 Patent, copper foils were conventionally subjected to tests under both ordinary temperature and high temperature and a person of ordinary skill would not have known with reasonable certainty which test was contemplated by the claim as discussed with respect to the "tensile strength of 30 to 40 $kgf/mm^2$" limitation in claim 1 of the '541 Patent, the discussion of which is incorporated by reference.

The specification also does not specify a standard to use in determining tensile strength. At the time of the '090 Patent, numerous standards were in existence for measuring tensile strength that a person of ordinary skill may have selected. For example, the prior art cited during prosecution identifies both IPC-TM-650 2.4.18 and JlS C 6515 for measuring tensile strength which differ in numerous respects including, for example, sample preparation and size, testing conditions and testing procedures. *See, e.g.,* PRIOR_ART-00000554-1229 (IPC-TM-650); PRIOR_ART-00001345(JIS C 6515); PRIOR_ART-00000217 (EP2660359) at [0093] (identifying IPC-TM-650); PRIOR_ART-00000250 (EP3067199) at [100] (citing IPC-TM-650);

PRIOR_ART-00000191 (EP1876266) at [0074] (citing JIS C 6515); PRIOR_ART-00002589 (JP2001011684A) at [0020]-[0021] (citing JIS C 6515); PRIOR_ART-00002266 (WO 2011/129633) at [0057] (citing IPC-TM-650 2.4.18B). A person of ordinary skill in the art would not have known with reasonable certainty which standard to use.

The specification also does not specify whether tensile strength is measured in the transverse direction (TD) or machine direction (MD). Further, the prior art cited during prosecution describes measurements in both directions, leaving a person of skill in the art without reasonable certainty as to which direction is required by the claim. *E.g.*, PRIOR_ART-00000191 (EP1876266) at [0047] ("In this connection, rolled copper foils, which can be said to be a representative of smooth-surface copper foils, are well known to have different mechanical properties between in the TD and MD due to their working method."), [0049].

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring tensile strength would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "tensile strength of 30 to 60 kgf/mm$^2$" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**3. '689 Patent**

The '689 Patent Asserted Claims are invalid under 35 U.S.C. § 112 ¶ 2 for indefiniteness because the claims, "read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). For example, a person of ordinary skill in the art would not be able to determine the scope of the alleged invention

because at least the following terms are indefinite.

**(a) (Claim 1) "a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190° C. for 1 hour, ranges from 21 to 36 kgf/mm$^2$"**

Claim 1 of the '689 Patent is indefinite with respect to the limitation "a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190° C. for 1 hour, ranges from 21 to 36 kgf/mm$^2$" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring weight deviation, and different measurement methods would have yielded materially different results. *See, e.g., Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). The specification and prosecution history fail to provide sufficient information regarding the method of measuring tensile strength. Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the tensile strength.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The majority of the specification's disclosures do little more than repeat the claim language. *See, e.g.*, '689 Patent at Abstract, 2:27-42, 3:1-4, 6:1-15, 11:24-23, 11:65-12:4. Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *E.g., id.* at 11:65-12:4 (providing that a particular "sample of the electrolytic copper foil was heat-treated at a temperature of 190° C. for 1 hour and a tensile strength of the heat-treated sample was then measured using a universal testing machine (UTM)" and that "[i]n this case, a width of the sample was 12.7 mm, a distance between grips was 50 mm and a measurement speed was 50 mm/min,").

For example, while the claim provides that tensile strength is "measured after a heat treatment at a temperature of 190° C. for 1 hour," neither it nor the specification indicates the temperature at which the tensile strength measurement should be taken following the heat treatment. At the time of the '090 Patent, copper foils were conventionally subjected to tests under both ordinary temperature and high temperature and a person of ordinary skill would not have known with reasonable certainty which test was contemplated by the claim as discussed with respect to the "tensile strength of 30 to 40 kgf/mm$^2$" limitation in claim 1 of the '541 Patent, the discussion of which is incorporated by reference. As another example, the specification does not disclose whether tensile strength is measured at a constant strain or a constant force, which may affect the measurement results.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring tensile strength would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190° C. for 1 hour, ranges from 21 to 36 kgf/mm$^2$" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 1) "a weight deviation of the electrolytic copper foil at 5% or less"**

Claim 1 of the '689 Patent is indefinite with respect to the limitation "a weight deviation of the electrolytic copper foil at 5% or less" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the

art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring weight deviation, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the weight deviation.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *See, e.g.*, '689 Patent at Abstract, 2:42-43, 3:4-5, 6:15-36, 9:24-34, 11:24-30, 12:5-20, 13:14-22. The specification states that weight deviation "may be obtained by taking 5 cm×5 cm samples at three points arranged in a width direction, that is, a transverse direction (TD) of the electrolytic copper foil." *Id.* at 6:16-20. However, the specification is not reasonably certain as to the numerous aspects of this test including, for example, the direction to cut the 5 cm x 5 cm sample, the number of test pieces to cut and measure, or how to cut the test pieces (e.g., the required precision of the size of the test pieces), which may affect the results.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring weight deviation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

**(c) (Claim 1) "each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less"**

Claim 1 of the '689 Patent is indefinite with respect to the limitation "each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less" because the claim, when read in

light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring surface roughness (Rz), and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring surface roughness (Rz).

Further, the specification is silent as to how to measure surface roughness (Rz). *See, e.g.*, '689 Patent at 5:21-25, 7:18-37, 7:60-64, 8:4-10, 8:61-65, 10:10-15. The specification fails to describe numerous aspects of testing such as for example sample preparation, the measurement equipment (e.g., a stylus/contact profilometer or an optical profilometer), settings to be used on the equipment (e.g., for contact profilometers, the stylus tip, pressure and measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, or how to calculate Rz, among other things.

At the time of the '541 Patent, numerous standards were in existence for measuring Rz that may yield different results including, for example, ASME B46.1 (2009), JIS B 0601 (1994), JIS B 0601 (2001) and JIS B 0601 (2013). *See, e.g.*, PRIOR_ART-00000554-1229 (IPC-TM-650); PRIOR_ART-00001345(JIS C 6515). The specification and prosecution history further contain references to both of these standards, adding to the ambiguity. For example, the specification cites "U.S. standard ASME B46.1-2009," to obtain a different surface measurement, namely peak count (Pc). '689 Patent. at 7:44-59. Further, during prosecution of the '689 Patent, the patent examiner found that prior art (Hirose) uses JIS B0601 (1994) to measure Rz. SKN-0000001 at -0071;

PRIOR_ART-00000478 (Hirose) at [0026]. The patent is also ambiguous as to whether Rz refers to Rz-JIS.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring surface roughness (Rz) would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(d) (Claim 2) "an elongation of 3% or more at room temperature"**

Claim 2 of the '689 Patent is indefinite with respect to the limitation "an elongation of 3% or more at room temperature" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus,* 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring elongation, and different measurement methods would have yielded materially different results. *See, e.g., Teva,* 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 2 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring elongation. It specifies that elongation is measured at room temperature, which the specification describes as "25±15°C" (i.e. 50-104°F), '689 Patent at 6:37-40, without providing guidance as to which temperature to use within this range. Further, different temperatures within this range would yield different results as discussed with respect to the "tensile strength of 30 to 40 kgf/mm$^2$" limitation in claim 1 of the

’541 Patent, the discussion of which is incorporated by reference.

Further, the specification’s minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The majority of the specification’s disclosures do little more than repeat the claim language without explaining how to measure elongation. *See, e.g.*, ’689 Patent at Abstract, 2:43-44, 6:37-53, 11:24-30, 12:21-25, 12:60-67, 13:4-13, Table 2. In addition, the specification’s disclosure that “[t]he elongation of the electrolytic copper foil at room temperature was measured using a UTM according to a method described in the IPC-TM-650 Test Method Manual,” *id.* at 12:23-25, does not render the scope of the claim reasonably certain.

The term “room temperature” is also indefinite because its meaning is not reasonably certain.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring elongation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term “an elongation of 3% or more at room temperature” is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**4. ’014 Patent**

The ’014 Patent Asserted Claims are invalid under 35 U.S.C. § 112 ¶ 2 for indefiniteness because the claims, “read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). For example, a

person of ordinary skill in the art would not be able to determine the scope of the alleged invention because at least the following terms are indefinite.

**(a) (Claim 1) "Rp/μm" and "the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard"**

Claim 1 of the '014 Patent is indefinite with respect to the following limitations "Rp/μm" and "the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring "Rp/μm" and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 provides that "peak height [is] measured according to JIS B 0601 (2001) standard." However, claim 1 fails to describe numerous aspects of testing such as for example sample preparation, the measurement equipment (e.g., a stylus/contact profilometer or an optical profilometer), settings to be used on the equipment (e.g., for contact profilometers, the stylus tip, pressure and measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things. Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *See, e.g.*, '014 Patent at 4:55-62 ("In Mathematical Expression 1, Rp is measured according to JIS B 0601 (2001) standards. At this time, a measurement length excluding a cutoff length was 4 mm, and the cutoff length was 0.8 mm at the early stage and at the late stage. Rp was measured using an SJ-310 surface roughness tester from Mitutoyo, wherein the radius of a stylus tip was 2 μm, and measurement pressure was 0.75 mN. The average of values measured

three times was taken as Rp.").

In addition, "Rp/μm" measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). The patent does not disclose any requirements as to the precise location of a sample to be used in assessing "Rp/μm," leaving it to the arbitrary discretion of the tester and random chance, further demonstrating that it is indefinite.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring "Rp/μm" would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the terms "Rp/μm" and "the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard" are indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 1) "peak density/30" and "the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is**

**measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm"**

Claim 1 of the '014 Patent is indefinite with respect to the following limitations "peak density/30" and "the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring "peak density/30" and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 provides that "the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of ±0.5 μm," However, claim 1 fails to describe numerous aspects of testing such as for example sample preparation, the measurement equipment (e.g., a stylus/contact profilometer or an optical profilometer), settings to be used on the equipment (e.g., for contact profilometers, the stylus tip, pressure and measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things. Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *See, e.g.*, '014 Patent at 4:63-5:5 ("Meanwhile, peak density is measured according to ASME B46.1 standards, and a peak count level is set to ±0.5 μm based on the center line of a profile. The peak density may be measured using an illuminometer (Marsurf M300 from Mahr). At this time, a measurement length excluding a cutoff length was 4 mm, and the cutoff length was 0.8 mm at the early stage and at the late stage. The radius of a stylus tip was

2 μm, and measurement pressure was 0.75 mN. The average of values measured three times was taken as the peak density.").

In addition, "peak density/30" measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness,* Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). The patent does not disclose any requirements as to the precise location of a sample to be used in assessing "peak density/30," leaving it to the arbitrary discretion of the tester and random chance, further demonstrating that it is indefinite.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring "peak density/30" would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the terms "peak density/30" and "the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to

ASME B46.1 (2009) standard with a peak count level of +/- 0.5 µm" are indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(c) (Claim 1) "amount of attachment of Cr/(mg/m^2)" and "the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer"**

Claim 1 of the '014 Patent is indefinite with respect to the following limitations "amount of attachment of Cr/(mg/m^2)" and "the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring "the amount of attachment of Cr (mg/m^2)," and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 provides that "amount of attachment of Cr (mg/m2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer." However, claim 1 does not explain, for example, the amount of time to dissolve the first surface or the second surface with the nitric acid solution or other aspects of the test that may impact its results.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The specification purportedly discloses how attachment of Cr "***may***" be measured:

> In addition, the amount of attachment of Cr in Mathematical Expression 1 ***may*** be measured as follows. The surface opposite to the surface of an electrolytic copper foil to be measured is masked with tape, a sample is cut to a size of 10 mm*10 mm, the surface of the sample to be measured is dissolved in a nitric acid solution (commercial nitric acid and water being mixed at a ratio of 1:1 and the temperature of the nitric acid solution being 70° C.) such that no hole is formed through the copper foil by the nitric acid, and the dissolved solution is diluted with water until the amount of the dissolved solution is 50 mL (temperature of the solution being 25±3° C.). The diluted solution is analyzed using an atomic absorption spectrometer (AAS) at a temperature of 25±3° C. The opposite surface may be analyzed using the same method. The average of values measured three times is taken as the amount of attachment of Cr.

'014 Patent at 5:6-22. However, the specification does not numerous aspects of the test including, for example, the amount of time required for the dissolution, or the use of any particular type of atomic absorption spectroscopy system. .

In addition, "the amount of attachment of Cr (mg/m^2)" measurements are performed repeatedly; "[t]he average of values measured three times was taken as the amount of attachment of Cr." '014 Patent at 10:55-56. Different samples may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular foil sample falls within the scope of the claims. A given copper foil sample may have "the amount of attachment of Cr (mg/m^2)" such that it falls within the claimed range. The patent does not disclose any requirements as to as to the precise location of a sample to be used in assessing "the amount of attachment of Cr (mg/m^2)," leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring

"the amount of attachment of Cr (mg/m^2)" would result in different values, and that repeat measurements of different samples taken from a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the terms "amount of attachment of Cr/(mg/m^2)" and "the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer" are indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(d) (Claim 1) Binding Coefficient Limitation**

Claim 1 of the '014 Patent is indefinite with respect to the following limitation: "binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer)" (referred to as the "Binding Coefficient Limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for determining the Binding Coefficient Limitation, and different methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). For the reasons discussed above in sections V.A.4.(a),(b),(c), a person of ordinary skill would not know with reasonable certainty the method for measuring "Rp/μm," and/or the method for measuring "peak density/30," and/or the method for measuring "amount of attachment of Cr/(mg/m^2)," and different measurement methods for those terms would have yielded materially different results used to calculate the Binding Coefficient Limitation. The variability in the measurements of the inputs to the Binding Coefficient Limitations is compounded and exacerbated when those inputs are used to calculate the Binding Coefficient Limitation.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring "Rp/μm," "peak density/30," and "amount of attachment of Cr/(mg/m^2)" would result in different values, hence different values for determining the "Binding Coefficient Limitation," and that repeat measurements of a particular foil may result in different "Binding Coefficient Limitations," such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the Binding Coefficient Limitation is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(e) (Claim 2) Texture Coefficient Limitation**

Claim 2 of the '014 Patent is indefinite with respect to the limitation requiring the "electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper

film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, 0.49 to 1.28,

$$TC(220) = \frac{\frac{I(220)}{I_0(220)}}{\frac{1}{n}\sum \frac{I(hkl)}{I_0(hkl)}} \qquad \text{(Mathematical Expression 2)}$$

wherein TC(220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, $I_0$(hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2θ), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes" (referred to as the "Texture Coefficient Limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring diffraction intensities used to claimed texture coefficient, and different methods of measurement would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). For example, the claim and specification fail to specify a variety of parameters relevant to XRD testing including the (1) use of a variable or fixed slit geometry; (2) size of the constant slit opening for the fixed geometry or the size of the irradiated area with the variable slit geometry; (3) alignment of the sample—e.g., longitudinal or transverse—with respect to the incident beam; (4) choice of which face of the

sample to be examined; (5) technique for fitting the background intensity; (6) choice of whether to smooth or filter the raw data; (7) application of a thin film correction; and (8) the x-ray characteristics including the incident angle, the accelerating energy, the irradiated dosage, and irradiation angle.

In *Sandvik* (W.D. Pa. July 24, 2012), the court found a similar texture coefficient limitation indefinite for reasons that similarly apply to the Texture Coefficient Limitation of the '014 Patent. *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012); Affidavit of William Edward Mayo, Ph.D. in Support of Defendant Kennemetal Inc.'s Responsive Claim Construction Brief, *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, Dkt. 109 (Nov. 22, 2010). The court found "Measured Intensity of the (hkl) Reflection" indefinite because "[t]est data demonstrates that the variation in the calculated value of TC(012) as a result of applying numerous collection and analytical factors that confronted one of skill in the art as of December 1992 made a meaningful difference in that the resulting TC(012) values of the same Sandvik GC415, GC3015, and GC4215 samples fell both within and without the greater than 1.3 (and/or 1.5) texture coefficient value required by the claims of the '625 Patent to infringe." *Sandvik*, 2012 WL 3028028, at *9. The defendants' expert, Dr. Mayo, further described testing data and analytical factors in his accompanying affidavit and summarized the measured impact of those factors in the table below:

**Table 14 Summary of Major Influences on Variability in TC(012)**

| Decision Point | Choice | Range of Variability in TC (012) | Conditions |
|---|---|---|---|
| Experimental | fixed slit instead of variable | 5% to 10% | Greater if beam spills over the sample edge |
| Experimental | large slit opening instead of smaller slit opening | 10% to 30% | Greater if beam spills over the sample edge |
| Experimental | use transverse alignment instead of longitudinal | 10% to 20% | Greater if beam spills over the sample edge |
| Experimental | surface to surface variability | 5% | Random choice |
| Analytical | subtract $K\alpha_2$ artifact | 9% | |
| Analytical | use raw data instead of smoothed or filtered data | 8% | |
| Analytical | use peak intensity instead of area intensity | 3% | |
| Analytical | include the thin film correction | 25% to 36% | |
| Computational | choice of reference intensity data set | 30% to 40% | |

Here, as in *Sandvik*, the application of different settings and parameters for XRD data collection and analysis would result in meaningful differences in the calculation of texture coefficients, rendering the claim indefinite. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d at 633–34 (Fed. Cir. 2015).[4]

The Texture Coefficient Limitation is also indefinite to the extent $I_0$(hkl) is not construed to require any specified JCPDS (Joint Committee for Powder Diffraction Studies) card for standard powder specimens of copper (Cu). *See, e.g.*, *Sandvik*, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012) (holding that "'$I_0$(hkl) = standard intensity of the ASTM standard powder pattern diffraction data,' is not sufficiently precise to permit a potential infringer to determine the bounds

[4] Although *Sandvik* concerned α-alumina, the application of different settings and parameters for XRD data collection and analysis would also have a material impact on measured characteristics of copper foils like those required by claim 1 of the '541 Patent.

of the claims of the ’625 Patent”). A person of ordinary skill would not know with reasonable certainty which standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS) to use in the calculation. Further, numerous standard-powder shaped diffraction data were in existence at the time of the ’014 Patent that would result in different calculations of texture coefficients as well as different calculations of texture coefficient of the (220) plane as required by claim 2.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in XRD data collection would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the Texture Coefficient Limitation is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(f) (Claim 3) “weight deviation in lateral direction of the electrolytic copper foil is less than 3%”**

Claim 3 of the ’014 Patent is indefinite with respect to the limitation “weight deviation in lateral direction of the electrolytic copper foil is less than 3%” because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring weight deviation, and different measurement methods would yield materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 3 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the weight deviation.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. For example, the specification describes "cutting a copper foil by an area of 5 cm×5 cm to make a sample, measuring the weight of the sample and converting the measured weight into a weight value of the copper foil per unit area, repeatedly performing the sample cutting process in the lateral direction of the copper foil, measuring weight values of the copper foil of respective samples, and calculating a standard deviation." *See* '014 Patent at 6:26-35. However, the specification is not reasonably certain as to the numerous aspects of this test including, for example, the direction to cut the 5 cm x 5 cm sample, the number of test pieces to cut and measure, or how to cut the test pieces (e.g., the required precision of the size of the test pieces). The standard deviation of the copper foil's weight may vary greatly depending on the precise size of the test pieces and the number of test pieces measured. Further, the specification fails to describe numerous other aspects of testing such as for example sample preparation, requirements of both the equipment used to cut the sample as well as the instruments used to take weight measurements (e.g., angle (in degrees) of cutting blade, capacity and resolution of scale), settings, if any, to be used on the equipment (e.g., whether or how much tension the copper foil is under when cut), filters to be applied to the data, among other things.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring weight deviation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "weight deviation in lateral direction of the electrolytic copper foil is less than 3%" is indefinite. In addition, for the same reasons, claims

depending on this claim are also indefinite.

**(g) (Claim 4) "yield strength of 21 to 49 kgf/mm2"**

Claim 4 of the '014 Patent is indefinite with respect to the limitation "yield strength of 21 to 49 kgf/mm$^2$" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring yield strength, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 4 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the tensile strength. For example, it does not explicitly require a standard, a particular type of universal testing machine (e.g., electromechanical or hydraulic, etc.), sample parameters or testing parameters.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The majority of the specification's disclosures pertain to values of the tensile strength without explaining how those values were obtained. *See, e.g.*, '014 Patent at 2:42-44, 6:35-45, Table 3. The specification further discloses that yield strength "***may*** be measured using a universal testing machine (UTM) according to methods defined in the IPC-TM-650 Test Method Manual" and that "[i]n ***an embodiment***" the machine may be a "universal testing machine from Instron Company," along with some information regarding the sample dimensions, distance between grips and measurement speed:

> The yield strength of a sample may be measured using a universal testing machine (UTM) according to methods defined in the IPC-TM-650 Test Method Manual. In an embodiment of the present disclosure, the yield strength of a sample is measured using a universal testing machine from Instron Company. The width of a sample for measurement is 12.7 mm, the distance between grips is 50 mm, and the

> measurement speed is 50 mm/min. For evaluation, the yield strength of the sample may be repeatedly measured three times, and the average thereof may be taken as the yield strength of the copper foil 100.

*Id.* at 6:44-55. However, the specification fails to describe numerous other aspects of the testing including, for example, sample selection, preparation, settings and parameters used on equipment, among other things. Specifically, a POSITA does not know if they should obtain five samples through a cutting machine calibrated to a sample width of 12.7 mm, but only use the middle three samples. Another example would be a POSITA would not know whether to set up the cutting machines to cut in either a longitudinal or transverse direction. The specification also fails to discuss the calibration of the load cell, which would occur prior to measuring the tensile strength.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different testing samples from the same foil specimen, along with different settings and parameters used in measuring yield strength, would result in different values, and therefore that repeat measurements for the same foil specimen may result in different values such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "yield strength of 21 to 49 kgf/mm$^2$" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**5. '706 Patent**

The '706 Patent Asserted Claims are invalid under 35 U.S.C. § 112 ¶ 2 for indefiniteness because the claims, "read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). For example, a

person of ordinary skill in the art would not be able to determine the scope of the alleged invention because at least the following terms are indefinite.

**(a) (Claim 1) Texture Coefficient Limitation**

Claim 1 of the '706 Patent is indefinite with respect to the limitation requiring the "a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,

$$TC(220) = \frac{\frac{I(220)}{I_0(220)}}{\frac{1}{n}\sum \frac{I(hkl)}{I_0(hkl)}} \qquad \text{(Equation 1)}$$

„

(referred to as the "Texture Coefficient Limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring diffraction intensities used to calculate the claimed texture coefficient, and different methods of measurement would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). For example, the claim and specification fail to specify a variety of parameters relevant to XRD testing including the (1) use of a variable or fixed slit geometry; (2) size of the constant slit opening for the fixed geometry or the size of the irradiated area with the variable slit geometry; (3) alignment of the sample—e.g., longitudinal or transverse—with respect to the incident beam; (4) choice of which face of the sample to be examined; (5) technique for fitting the background intensity; (6) choice of whether to smooth or filter the raw data; (7) application of a thin film correction; and (8) the x-ray characteristics including the incident angle, the accelerating energy, the irradiated dosage, and irradiation angle.

In *Sandvik* (W.D. Pa. July 24, 2012), the court found a similar texture coefficient limitation indefinite for reasons that similarly apply to the Texture Coefficient Limitation of the '706 Patent. *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012); Affidavit of William Edward Mayo, Ph.D. in Support of Defendant Kennemetal Inc.'s Responsive Claim Construction Brief, *Sandvik Intell. Prop. AB v. Kennametal, Inc.*, No. 2:10-CV-00654, DKt. No. 109 (Nov. 22, 2010). The court found "Measured Intensity of the (hkl) Reflection" indefinite because "[t]est data demonstrates that the variation in the calculated value of TC(012) as a result of applying numerous collection and analytical factors that confronted one of skill in the art as of December 1992 made a meaningful difference in that the resulting TC(012) values of the same Sandvik GC415, GC3015, and GC4215 samples fell both within and without the greater than 1.3 (and/or 1.5) texture coefficient value required by the claims of the '625 Patent to infringe." *Sandvik*, 2012 WL 3028028, at *9. The defendants' expert, Dr. Mayo, further described testing data and analytical factors in his accompanying affidavit and summarized the measured impact of those factors in the table below:

**Table 14 Summary of Major Influences on Variability in TC(012)**

| Decision Point | Choice | Range of Variability in TC (012) | Conditions |
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| Experimental | large slit opening instead of smaller slit opening | 10% to 30% | Greater if beam spills over the sample edge |
| Experimental | use transverse alignment instead of longitudinal | 10% to 20% | Greater if beam spills over the sample edge |
| Experimental | surface to surface variability | 5% | Random choice |
| Analytical | subtract $K\alpha_2$ artifact | 9% | |
| Analytical | use raw data instead of smoothed or filtered data | 8% | |
| Analytical | use peak intensity instead of area intensity | 3% | |
| Analytical | include the thin film correction | 25% to 36% | |
| Computational | choice of reference intensity data set | 30% to 40% | |

Here, as in *Sandvik*, the application of different settings and parameters for XRD data collection and analysis would result in meaningful differences in the calculation of texture coefficients rendering the claim indefinite. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d at 633–34 (Fed. Cir. 2015).[5]

The Texture Coefficient Limitation is also indefinite because it is not reasonably certain as to the copper foil card corresponding to $I_0$ (220) or $I_0$(hkl).

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The majority of the specification's disclosures pertain to values of the texture coefficient without explaining how it was obtained.

[5] Although *Sandvik* concerned α-alumina, the application of different settings and parameters for XRD data collection and analysis would also have a material impact on measured characteristics of copper foils like those required by claim 1 of the '541 Patent.

*See, e.g.*, '706 Patent at Abstract, 2:10-24, 3:45-4:21, 6:5-20, 8:16-25, 10:47-58, 11:7-22. The specification further discloses that:

> In Equation 1 above, I(hkl) indicates the XRD diffraction intensity of (hkl) crystal plane of a sample, and $I_0$ (hkl) indicates the diffraction intensity of (hkl) crystal plane of standard copper powder, set forth by the Joint Committee on Powder Diffraction Standards (JCPDS) (X-ray light source: Cu $K_{a1}$). Also, in Equation 1, 1 to n indicate the number of diffraction peaks within a specific range of diffraction angle 2θ. In the present disclosure, the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees, and remarkable crystal planes that are considered are (111), (200), (220), and (311) planes (that is, n=4). Consequently, the texture coefficient of (220) plane indicates the ratio of the peak intensity of (220) plane normalized with the peak intensity of standard Cu to the average peak intensity of (111), (200), (220), and (311) planes normalized with the peak intensity of standard Cu in the X-ray diffraction pattern of the sample.

'706 Patent at 3:58-4:8; *see also, e.g.*, *id.* at 8:17-25 (similar). However, the disclosures in the specification dot remedy the above-identified issues.

The Texture Coefficient Limitation is also indefinite to the extent $I_0$(hkl) is not construed to require any specified JCPDS (Joint Committee for Powder Diffraction Studies) card for standard powder specimens of copper (Cu). *See, e.g.*, *Sandvik*, 2012 WL 3028028, at *10 (W.D. Pa. July 24, 2012) (holding that "'Io(hkl) = standard intensity of the ASTM standard powder pattern diffraction data,' is not sufficiently precise to permit a potential infringer to determine the bounds of the claims of the '625 Patent"). A person of ordinary skill would not know with reasonable certainty which standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS) to use in the calculation. Further, numerous standard-powder shaped diffraction data were in existence at the time of the '706 Patent that would result in different texture coefficients.

The Texture Coefficient Limitation is also indefinite as to the value of "n" to be used in the claimed summation, and the planes considered for calculating the Texture Coefficient Limitation, to the extent it is not construed to require a particular value of n or particular planes.

*See* ’706 Patent at 3:58-4:8 (“Also, in Equation 1, 1 to n indicate the number of diffraction peaks within a specific range of diffraction angle 2θ. In the present disclosure, the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees, and remarkable crystal planes that are considered are (111), (200), (220), and (311) planes (that is, n=4). Consequently, the texture coefficient of (220) plane indicates the ratio of the peak intensity of (220) plane normalized with the peak intensity of standard Cu to the average peak intensity of (111), (200), (220), and (311) planes normalized with the peak intensity of standard Cu in the X-ray diffraction pattern of the sample.”).

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in XRD data collection would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the Texture Coefficient Limitation is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 1) Rz**

Claim 1 of the ’706 Patent is indefinite with respect to the limitation “Rz” because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring Rz, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir.

2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring Rz.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. *See, e.g.*, '706 Patent at Abstract, 2:10-35, 4:22-52, 6:29-39, 6:49-61, 7:11-17, 8:27-35, Table 2, 10:35-11:22. The specification discloses, for example, that "Rz indicates ten-point average roughness," *id.* at 4:26-27, and that "[i]n the present disclosure, Rz and Ra may be measured according to JIS B 0601(2001) standards." *Id.* at 4:33-35. It further discloses that:

> Rz and Ra were measured according to JIS B 0601 (2001) standards using a stylus tip from Mitutoyo Company, the model name of which was SJ-310 and which had a radius of 2 μm, under a condition of a measurement pressure of 0.75 mN. At this time, the measurement length, excluding the cut-off length, was 4 mm, the cut-off length was 0.8 mm at the first stage and the last stage, and the average of the values obtained by performing the measurement three times was taken.

*Id.* at 8:27-35. However, the specification fails to describe numerous other aspects of testing such as for example sample preparation, settings to be used on the equipment (e.g., for contact profilometers, the measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things.

In addition, Rz measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to

random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). A given copper foil sample may have an Rz within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the precise location of a sample to be used in assessing Rz, leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring Rz would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "Rz" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(a) (Claim 1) Ra**

Claim 1 of the '706 Patent is indefinite with respect to the limitation "Ra" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring Ra, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring Ra.

Further, the specification's minimal description does not render the scope of the term

reasonably certain, even if it were required by the claim. *See, e.g.*, '706 Patent at Abstract, 2:10-35, 4:22-52, 6:29-39, 6:49-61, 7:11-17, 8:27-35, Table 2, 10:35-11:22. The specification discloses, for example, that "Ra indicates arithmetical average roughness," *id.* at 4:26-27, and that "[i]n the present disclosure, Rz and Ra may be measured according to JIS B 0601(2001) standards." *Id.* at 4:33-35. It further discloses that:

> Rz and Ra were measured according to JIS B 0601 (2001) standards using a stylus tip from Mitutoyo Company, the model name of which was SJ-310 and which had a radius of 2 μm, under a condition of a measurement pressure of 0.75 mN. At this time, the measurement length, excluding the cut-off length, was 4 mm, the cut-off length was 0.8 mm at the first stage and the last stage, and the average of the values obtained by performing the measurement three times was taken.

*Id.* at 8:27-35. However, the specification fails to describe numerous other aspects of testing such as for example sample preparation, settings to be used on the equipment (e.g., for contact profilometers, the measurement speed; for optical profilometers, the light intensity and angle of incidence), filters to be applied to the data, among other things.

In addition, Ra measurements are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas, T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). A given copper foil sample may have

an Ra within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the precise location of a sample to be used in assessing Ra, leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring Ra would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "Ra" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(b) (Claim 1) "a difference (|Δ(Rz/Ra))|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil"**

Claim 1 of the '706 Patent is indefinite with respect to the following limitation "a difference (|Δ(Rz/Ra))|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

For example, as discussed above, each of Rz and Ra are indefinite. The variability in the measurements to the inputs to this limitation are compounded and exacerbated when those inputs are used to calculate |Δ(Rz/Ra))|.

Thus, for at least these reasons, the term "a difference (|Δ(Rz/Ra))|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(c) (Claim 1) "a difference (|ΔPD|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil"**

Claim 1 of the '706 Patent is indefinite with respect to the following limitation "a difference (|ΔPD|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus,* 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for determining the "(|ΔPD|) limitation," and different methods would have yielded materially different results. *See, e.g., Teva,* 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.,* 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 1 fails to specify a particular method for measuring the (|ΔPD|) limitation.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The specification discloses that peak density PD "was measured according to ASME B46.1 standards. . . using a roughness tester from Mahr Company (Model name: marsurf M300)" for the values in Table 2." '706 Patent at 10:7. However, the specification fails to describe numerous other aspects of testing such as for example sample preparation, settings to be used on the equipment (e.g., the stylus tip, pressure and measurement speed), among other things.

In addition, peak density PD measurements (to determine the (|ΔPD|) limitation) are performed over an area of the surface of a sample and repeat measurements in the same or different locations on a particular copper foil sample may yield significantly different results, such that a person of ordinary skill would not know with reasonable certainty whether a particular copper foil sample falls within the scope of the claims. *See, e.g.*, PRIOR_ART-00002075 at -2078 (Thomas,

T.R., *Characterization of Surface Roughness*, Precision Engineering (1981 IPC Business Press)) ("Finally, it must not be overlooked that roughness parameters, being necessarily imperfect statistical representations of very complex geometrical structures, are more prone than many other physical measurements to scatter due to random samplings. It is fruitless for theoreticians to argue or quality control engineers to prescribe differences of one or two percent when ***sampling error can amount routinely to 20%-50% or more about the mean of the quantity being measured***."). A given copper foil sample may have peak density PD measurements (and thus (|ΔPD|) values) within the claimed range at one location but outside of the claimed range at another location. The patent does not disclose any requirements as to the location of a sample to be used in assessing peak density PD, leaving it to the arbitrary discretion of the tester and random chance.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that repeat measurements of a particular foil using different types of profilometers with different settings and parameters used in measuring peak density PD (and thus (|ΔPD|) values) may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonably certainty.

Thus, for at least these reasons, the (|ΔPD|) limitation is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(d) (Claim 2) Rz/Ra at the M Surface Limitation**

Claim 2 of the '706 Patent is indefinite with respect to the following limitation "the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0" because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014). The limitation is indefinite for at least the same reasons as the Rz and Ra limitations discussed above, the discussions of which are incorporated by reference herein.

### (e) (Claim 3) Rz/Ra at the S Surface Limitation

Claim 3 of the '706 Patent is indefinite with respect to the following limitation "the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8." (referred to as the "Rz/Ra at the S surface limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014). The limitation is indefinite for at least the same reasons as the Rz and Ra limitations discussed above, the discussions of which are incorporated by reference herein.

### (f) (Claim 4) "tensile strength, measured at room temperature, of 30 to 65 kgf/mm$^2$"

Claim 4 of the '706 Patent is indefinite with respect to the limitation "tensile strength, measured at room temperature, of 30 to 65 kgf/mm$^2$" (referred to as the "tensile strength of electrolytic copper foil" limitation for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring tensile strength, and different measurement methods would have yielded materially different results. *See, e.g., Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 4 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring the tensile strength. It specifies that tensile strength is measured at room temperature, whereas the specification describes "room temperature (25±15°C)" (i.e. 50-104°F), '706 Patent at 5:14, without providing guidance as to which temperature to use within this range. Further, different temperatures within this range would yield different results as discussed with respect to the "tensile strength of 30 to 40 kgf/mm$^2$"

limitation in claim 1 of the '541 Patent, the discussion of which is incorporated by reference.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. For example, the specification discloses that "[i]n the present disclosure, the tensile strength of an electrolytic copper foil may be measured using a universal testing machine (UTM) according to the guidelines set forth in the IPC-TM-650 Test Method Manual" and some aspects of measuring tensile strength "that "[i]n ***an embodiment*** of the present disclosure":

> In the present disclosure, the tensile strength of an electrolytic copper foil may be measured using a universal testing machine (UTM) according to the guidelines set forth in the IPC-TM-650 Test Method Manual. In an embodiment of the present disclosure, the tensile strength of an electrolytic copper foil is measured using a universal testing machine from Instron Company. The tensile strength of an electrolytic copper foil is measured under the conditions in which the width of the sample is 12.7 mm, the distance between grips is 50 mm, and the measurement speed is 50 mm/min. For evaluation, the tensile strength of an electrolytic copper foil may be repeatedly measured three times, and the average of the measured tensile strengths may be taken as the tensile strength of the electrolytic copper foil.

'706 Patent at 4:64-5:11. However, the specification fails to describe numerous other aspects of testing such as for example sample selection, preparation, settings and parameters used on the equipment, among other things.

The term "room temperature" is also indefinite because its meaning is not reasonably certain.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring tensile strength would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "tensile strength, measured at room temperature,

of 30 to 65 kgf/mm$^2$" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

**(g) (Claim 5) "elongation measured at room temperature, of 3% or more"**

Claim 5 of the '706 Patent is indefinite with respect to the limitation "elongation measured at room temperature, of 3% or more" (referred to as the "elongation limitation" for brevity) because the claim, when read in light of the specification and prosecution history, fails to inform with reasonable certainty those skilled in the art about the scope of the alleged invention. *See Nautilus*, 572 U.S. at 901 (2014).

A person of ordinary skill would not know with reasonable certainty the method for measuring elongation, and different measurement methods would have yielded materially different results. *See, e.g.*, *Teva*, 789 F.3d at 1345 (Fed. Cir. 2015); *Dow Chem.*, 803 F.3d 620, 633–34 (Fed. Cir. 2015). Claim 5 does not specify, and a person of ordinary skill would not know with reasonable certainty, the particular method required for measuring elongation.

Further, the specification's minimal description does not render the scope of the term reasonably certain, even if it were required by the claim. The specification merely repeats the term "elongation" without providing adequate description of how to measure elongation. *See, e.g.*, '706 Patent at 5:11-14, 5:20-22. The specification discloses, for example, that "room-temperature elongation is the elongation when the test sample ruptures under the above-described tensile strength measurement conditions." *Id*. at 5:20-22. However, it fails to describe numerous aspects of the test as discussed above with respect to the tensile strength limitation of the '706 Patent. The term "room temperature" is also indefinite because its meaning is not reasonably certain.

Defendants further contend that additional evidence, such as documentary evidence and testing of copper foil samples, will show that different settings and parameters used in measuring

elongation would result in different values, and that repeat measurements of a particular foil may result in different values, such that a person of ordinary skill would not know the bounds of the claim with reasonable certainty.

Thus, for at least these reasons, the term "elongation of 3% or more" is indefinite. In addition, for the same reasons, claims depending on this claim are also indefinite.

### B. The Asserted Claims Are Invalid for Lack of Written Description and Enablement

Defendants contend that, at least under Plaintiff's actual and/or apparent application of the claims, the specifications of each of the Asserted Patents does not include a sufficient written description as required by 35 U.S.C. § 112. Section 112 requires that a patent specification "contain a written description . . . of the manner and process of making and using [the invention] in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same." 35 U.S.C. § 112 ¶ 1. A patent's written description "must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). The disclosure must "convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* The level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology, but a "mere wish or plan" for obtaining the alleged invention does not satisfy the written description requirement. *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1344 (Fed. Cir. 2013). Put another way, "a description that merely renders the invention obvious does not satisfy the requirement." *Ariad*, 598 F.3d at 1351. Instead, "all the limitations must appear in the specification." *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997).

Defendants further contend that, at least under Plaintiff's actual and/or apparent application of the claims, the specification of each of the Asserted Patents does not enable any person skilled in the relevant art to make and use the alleged inventions of the Asserted Claims without undue experimentation under 35 U.S.C. § 112. Section 112 requires that the specification "enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the" alleged invention. 35 U.S.C. § 112 ¶ 1. A claim is not enabled if, "at the effective filing date of the patent, one of ordinary skill in the art could not practice their full scope without undue experimentation." *Wyeth and Cordis Corp. v. Abbott Labs.*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). "This important doctrine prevents both inadequate disclosure of an invention and overbroad claiming that might otherwise attempt to cover more than was actually invented." *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1381 (Fed. Cir. 2012).

For example, the Asserted Claims are invalid for lack of written description and enablement because they fail to sufficiently describe the full scope of the claimed ranges of copper foil characteristics to show that the inventor(s) were in possession of the claimed ranges, or to permit a person of skill in the art to achieve the ranges without undue experimentation. The Federal Circuit has held that a failure to sufficiently describe the full scope of a claimed range in a patent's specification amounts to both a lack of written description and enablement. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021) (finding a patent lacked sufficient written description because "[i]n the case of a claimed range, a skilled artisan must be able to reasonably discern a disclosure of that range. No range of 'about 40 wt % to about 60 wt %' appears in the '571 application."); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012) (finding that a patent is invalid for insufficient enablement

when the "specification only enables an ordinarily skilled artisan to achieve a small subset of the claimed range.").

As another example, the Asserted Claims are also invalid for lack of written description and enablement because the claims purport to encompass a genus of copper foils having certain characteristics but the specifications fail to disclose "a representative number of species falling within the scope of the genus or structural features common to the members of the genus so that one of skill in the art can 'visualize or recognize' the members of the genus." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1350 (Fed. Cir. 2010); *see also, e.g.*, *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1346 (Fed. Cir. 2005) (finding written description to be insufficient where a claim covered all processes for compressing an image, but there was "no support for such a broad claim in the specification.").

As another example, the Asserted Claims are also invalid for lack of written description and enablement because their respective specifications fail to provide sufficient "blaze marks" to show that the inventor(s) were in possession of the full scope of the alleged inventions or to permit a person of skill in the art to make and use the full scope of the alleged inventions without undue experimentation. "One cannot disclose a forest in the original application, and then later pick a tree out of the forest and say here is my invention. In order to satisfy the written description requirement, the blaze marks directing the skilled artisan to that tree must be in the originally filed disclosure." *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1326–27 (Fed. Cir. 2000). *See also, e.g.*, *Fujikawa v. Wattanasin*, 93 F.3d 1559, 1571 (Fed. Cir. 1996) ("In the absence of such blazemarks, simply describing a large genus of compounds is not sufficient to satisfy the written description requirement as to particular species or subgenuses."). Rather, here, each of the Asserted Claims recites copper foils having wide ranges of characteristics whereas the

specification provides insufficient examples explaining how to make and use copper foils having those characteristics. *See, e.g.*, *Lipocine Inc. v. Clarus Therapeutics, Inc.*, 541 F. Supp. 3d 435, 458 (D. Del. 2021) (holding claims invalid for lack of written description where "the asserted patents are very broad, and the number of operative species disclosed in the specification is very small.").

**1. '541 Patent**

The Asserted Claims of the '541 Patent are invalid because they fail to satisfy the written description and enablement requirements of 35 U.S.C. § 112, ¶ 1. The Asserted Claims fail to satisfy the written description requirement because the written description does not reasonably convey to persons of ordinary skill in the art that the alleged inventors had possession of the full scope of the claimed subject matter as of the effective filing date of the patent. *See, e.g.*, *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In addition, the Asserted Claims fail to satisfy the enablement requirement because, as of the effective filing date of the patent, a person of ordinary skill in the art could not practice their full scope without undue experimentation. *See, e.g., Wyeth & Cordis Corp. v. Abbott Lab'ys*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The Asserted Claims fail to satisfy the written description and enablement requirement for at least the following exemplary reasons discussed below.

**(a) General Issues**

The Asserted Claims of the '541 Patent recite copper foils having specific characteristics "so as to prevent the generation of wrinkles at a surface of the coper foil," including for example four ratios of the sum of texture coefficients, "a weight deviation of 3% or less," "a tensile strength of 30 to 40 kgf/mm$^2$," "a surface roughness (Rz-JIS) of 2 μm or less," an "elongation of 3 to 20%," and "a thickness of 1 to 35 μm." However, the specification fails to include a description sufficient to show that the inventors were in possession of the full scope of the claims or to otherwise permit

a person of ordinary skill to make and use the full scope of the claims, including the claimed combination of limitations, without undue experimentation as required by 35 U.S.C. § 112, ¶ 1. *See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012); *Ariad Pharms.*, 598 F.3d at 1350-51 (Fed. Cir. 2010); *LizardTech*, 424 F.3d at 1346 (Fed. Cir. 2005); *Purdue Pharma*, 230 F.3d at 1326–27 (Fed. Cir. 2000).

The specification does not describe copper foils having characteristics throughout the full scope of the claimed ranges. In the specification, Table 1 identifies only seven Examples of copper foils having characteristics within the claimed ranges (in addition to nine "Comparative Examples" of copper foils having at least one characteristic outside of the claimed range):

TABLE 1

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Copper foil | Electrodeposited copper foil | | | | | | | | | | | | | | | |
| Thickness of copper foil [μm] | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| (111) + (200) ratio [%] | 76 | 62 | 83 | 70 | 72 | 81 | 66 | 64 | 73 | 62 | 83 | 87 | 57 | 80 | 75 | 76 |
| (111) ratio [%] | 26 | 31 | 32 | 20 | 35 | 22 | 36 | 16 | 41 | 37 | 19 | 34 | 26 | 30 | 23 | 25 |
| (200) ratio [%] | 50 | 31 | 51 | 50 | 36 | 59 | 30 | 48 | 32 | 25 | 64 | 53 | 31 | 49 | 51 | 50 |
| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |
| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |
| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |
| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |

The Examples do not support the full scope of the claimed ranges as summarized in the table below:

| **Characteristic** | **Claimed Range** | **Example Range** | **Comparative Example Range** |
|---|---|---|---|
| Thickness (μm) | All (claim 1)<br>1-35 (claim 4) | 8 | 8 |

| | | | |
|---|---|---|---|
| Texture Coefficient Ratio ((111) + (200)) (%) | 60-85 | 62-83 | 57-87 |
| Texture Coefficient Ratio (111) (%) | 18-38 | 20-36 | 16-41 |
| Texture Coefficient Ratio (200) (%) | 28-62 | 31-59 | 25-64 |
| Texture Coefficient Ratio (220) (%) | 15-40 | 17-38 | 13-38 |
| Tensile Strength ($kg/mm^2$) | 30-40 | 32.1-37.2 | 27.4-41.5 |
| Weight Deviation (%) | 0-3 | 0.4-2.6 | 0.5-3.4 |

*See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). To the extent Plaintiff contends that the differences between the range of the Examples and the claimed ranges are minor, during prosecution the Applicant of the '541 Patent argued that the claimed ranges are "critical" and that even "little" differences in the values of characteristics may be material:

> In addition, referring to Table 1 of this application, Comparative Examples 1 to 6 satisfy the numerical ranges of the tensile strength and the weight deviation, defined in Claim 1 of this application, but do not satisfy at least one of the numerical ranges of four the texture coefficient ratios, which results in generation of wrinkles. In detail, as seen from Comparative Examples 1 and 2, ***if the (111) ratio deviates just a little below or above the range of Claim 1, wrinkles are generated*** even though the other conditions of Claim 1 are satisfied. In addition, as seen from Comparative Examples 3 and 4, ***if the (200) ratio deviates just a little below or above the range of Claim 1, wrinkles are generated*** even though the other conditions of Claim l are satisfied. Moreover, as seen from Comparative Examples 5 and 6, ***if the (222) ratio and the (111)+(200) ratio deviate just a little below or above the ranges of Claim 1, wrinkles are generated*** even though the other conditions of Claim 1 are satisfied.
>
> In addition, Comparative Examples 7 and 8 satisfy the numerical ranges of the weight deviation and four texture coefficient ratios, defined in Claim 1 of this application, but do not satisfy the numerical range of the tensile strength, resulting in the generation of wrinkles. In detail, as seen from Comparative Examples 7 and 8, ***if the tensile strength deviates just a little below or above the range of Claim 1, wrinkles are generated even though the other conditions of Claim 1 are satisfied***.
>
> Moreover, Comparative Example 9 satisfies the numerical range of the tensile strength and four texture coefficient ratios, defined in Claim 1 of this application, but does not satisfy the numerical range of the weight deviation, resulting in the generation of wrinkles. In detail, as seen from Comparative Example 9, if the weight deviation deviates just a little above the range of Claim 1, wrinkles are generated even though the other conditions of Claim 1 are satisfied. Meanwhile, Examples 1 to 7 satisfy the numerical ranges of all conditions, defined in Claim 1

> of this application, and no wrinkles are created. ***Therefore, the numerical ranges of four texture coefficient ratios, the tensile strength and the weight deviation, defined in Claim l of this application, are critical to the prevention of wrinkles***.

2016/02/18 Applicant Response (SKN-0001767 at -2347-2348).

To compound the problem, the specification fails to provide a sufficient description of chemical compositions and manufacturing processes that would prevent wrinkles or otherwise result in copper foils having the combination of claimed characteristics so as to show possession of the alleged invention or permit a person of ordinary skill to make and use it without undue experimentation. In fact, the specification does not disclose the particular composition or manufacturing process of ***any*** of the Examples or Comparative Examples, leaving a person of ordinary skill to rely on undue experimentation and guesswork to create even these copper foils. Moreover, the specification's description of composition and manufacturing process is brief, vague and inadequate. It describes using conventional "additives" in a copper sulfate solution while providing minimal detail on an electrodeposition process, reciting broad ranges of "current density of 30 to 80 ASD (A/dm2)" and "temperature[s] of 30 to 60° C":

> Preferably, the copper foil for a current collector of a lithium secondary battery according to the present invention is made by adding a small amount of organic additives to a copper sulfate solution containing copper sulfate, sulfuric acid and chlorine. Here, the additive may be a sulfonate-based additive containing sulfide as a brightener to polish a plating surface and obtain a fine plating layer, gelatin having a low molecular weight of 1,000 to 100,000 as a leveler added to obtain a low roughness copper foil, or a cellulose-based additive serving as a suppressor to realize a stable low roughness. As the process condition, copper is electrodeposited on a drum surface of a foil making machine with a current density of 30 to 80 ASD (A/dm2) at a temperature of 30 to 60° C., and the surface of the copper foil is chromated to prevent corrosion.

'541 Patent at 3:3-22; *see also id.* at 3:23-50. It fails to describe a complete or specific chemical composition or relevant aspects of the manufacturing process such as, for example, the concentration of copper, plating solution pH, drum material, drum size, drum surface roughness, solution velocity at the plating interface, rotational speed, anode material, voltage, heat treatment,

etc., leaving a person of ordinary skill to resort to undue experimentation in order to practice the claims.

As a result of these deficiencies, the patent does not show that the inventors were in possession of the alleged invention or permit a person of ordinary skill to make copper foils having the claimed characteristics without undue experimentation. These General Issues are incorporated by reference into the additional discussion of each limitation below.

**(b) (Claim 1) Texture Coefficient Limitation**

The '541 Patent fails to provide sufficient written description support, or enable, "wherein, in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, wherein the texture coefficient satisfies the following equation:

$$TC(hkl) \geq \frac{\frac{I(hkl)}{I_0(hkl)}}{\frac{1}{n}\Sigma\frac{I(hkl)}{I_0(hkl)}}$$

wherein I(hkl) represents a measured diffraction intensity with respect to a (hkl) surface, and I0(hkl) represents a standard diffraction intensity of ASTM (American Society of Testing Materials) standard powder-shaped diffraction data" as recited in claim 1.

The specification does not sufficiently describe how to manufacture a copper foil having

such a crystalline structure so as to enable a person of ordinary skill in the art to create it without undue experimentation. The specification explains, generically, that "[s]uch a crystalline structure may be obtained by controlling additives or plating conditions during an electroplating process for making a copper foil" but does not explain how to control additives or plating conditions to arrive at the crystalline structure:

> Such a crystalline structure may be obtained by controlling additives or plating conditions during an electroplating process for making a copper foil. In detail, the plating solution for obtaining the crystalline structure basically includes a copper sulfate plating solution having copper sulfate, sulfuric acid and chlorine, to which at least two kinds of organic additives selected from the following group are added in the range of 1 to 50 ppm, respectively. The organic additive includes a gelatin-based compound with a molecular weight of 1,000 to 100,000 or a cellulose-based compound in addition to a mercapto compound. As the plating conditions to obtain the crystalline structure, copper is electrodeposited onto a drum surface of a foil making machine with a current density of 30 to 80 ASD at a temperature of 30 to 60° C. to make an original foil, and a nodule is formed thereat as necessary. After that, the surface of the copper foil is finally chromated to prevent corrosion.

*Id.* at 3:33-50. In light of this minimal disclosure, a person of ordinary skill must perform undue experimentation to create a crystal structure having the claimed characteristics.

The specification also fails to disclose copper foils having texture coefficients or ratios of texture coefficients throughout the entirety of the claimed ranges. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior,* 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil,* 687 F.3d at 1383-84 (Fed. Cir. 2012).

The specification also fails to disclose or enable a copper foil satisfying the full range of each component ratio of the Texture Coefficient Limitation while simultaneously satisfying other component ratios as well as other copper foil characteristics that are within the scope of the claim and that may affect these limitations such as, for example, a "thickness of 1 to 35 μm," as well as "a weight deviation of 3% or less," "a tensile strength of 30 to 40 kgf/mm$^2$, "so as to prevent the

generation of wrinkles at a surface of the copper foil," (claim 2) "a surface roughness (Rz-JIS) of 2 μm or less," (claim 3) "elongation of 3 to 20%"; (claim 4) "a surface roughness (Rz-JIS) of 2 μm or less." For example, according to the prior art cited during prosecution of the '541 Patent, "the X-ray diffraction intensity depends on the thickness of the copper thin film." PRIOR_ART-00002636 (U.S. Patent No. 5,501,911) at 4:55-58; *see also, e.g.*, *id.* at 3:18-20.

**(c) (Claim 1) "a weight deviation of 3% or less"**

The '541 Patent fails to provide sufficient written description to support, or enable, "a weight deviation of 3% or less" as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe copper foils having a weight deviation throughout the entirety of the claimed range between 0 and 3%, including the low end of the range greater than or equal to 0% and less than 1.2%. For example, in the Examples of Table 1, the weight deviation ranges from 0.4 to 1.2. '541 Patent at Table 1. To the extent they are relevant, the Comparative Examples—which have at least one characteristic outside of the claimed ranges—disclose copper foils having weight deviations ranging from .5% to 3.4% and do not meet the full scope of the claimed range. *Id.* The specification's repetition of the claim's aspirational language of "3% or less" does not demonstrate possession of, or enable, a copper foil having a weight deviation at the low end of the claimed range. *See, e.g.*, '541 Patent at Abstract, 2:25-26, 4:25-39. The specification does not otherwise disclose how to control the weight deviation such that it could be

achieved near the low end of the range.

The applicant for the ’541 Patent further admitted during prosecution that it would be challenging for a person of ordinary skill in the art to create a copper foil having a low weight deviation. In particular, the applicant argued that “a weight deviation inevitably occurs in the width or length direction of the copper foil, and generally the weight deviation is great”; that “there is no copper foil in which the weight deviation is 0”; and that “it is not easy to reduce the weight deviation”:

> The electrodeposited copper foil is prepared by laminating copper by an electric current flowing to an electrolyte. In this process, it is required for controlling a concentration of the electrolyte and a current density, but a weight deviation inevitably occurs in the width or length direction of the copper foil, and generally the weight deviation is great. Copper foils currently available on the market have weight deviation, and there is no copper foil in which weight deviation is 0. Moreover, it is not easy to reduce the weight deviation. In addition, in the related art, it is known that the weight deviation of the copper foil may cause a fault in fabrication of PCB, but it is not known in the art at all that the weight deviation of the copper foil gives an influence on the generation of wrinkles at the surface of the copper foil, which is different from the subject invention.

2016/02/18 Applicant Response (SKN-0001767 at -2346).

The specification also fails to disclose or enable a copper foil with a weight deviation at the low end of the “3% or less” range while simultaneously satisfying other copper foil characteristics that are within the scope of the claim and that may affect the weight deviation such as, for example, a “thickness of 1 to 35 μm” as well as the claimed ratios of texture coefficients, “tensile strength of 30 to 40 kg/mm$^2$,” “surface roughness (Rz-JIS) of 2 μm or less” and “elongation of 3 to 20%.” For example, in each of the Examples, the thickness is held constant at 8 μm whereas the weight deviation ranges from 0.4 to 1.2. However, claims 1 and 4 encompass copper foils having thicknesses of near-zero μm and 1 μm, respectively, with weight deviations as low as near-zero percent. At such small thicknesses, inconsistencies in manufacturing would have more pronounced effects on weight deviation, and it would require undue experimentation for a

person of ordinary skill to create a copper foil having a weight deviation near zero percent. Conversely, at large thicknesses (e.g., near 35 μm), more pronounced inconsistencies in manufacturing, and it would require undue experimentation for a person of ordinary skill to create a copper foil having a weight deviation near zero percent.

**(d) (Claim 1) "a tensile strength of 30 to 40 kgf/mm$^2$"**

The '541 Patent fails to provide sufficient written description support, or enable, "a tensile strength of 30 to 40 kgf/mm$^2$" as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012).

The specification does not describe copper foils having tensile strength throughout the entirety of the claimed range of "30 to 40 kgf/mm$^2$." For example, in the Examples of Table 1, the tensile strength ranges from 32.1-37.2 kgf/mm$^2$. '541 Patent at Table 1. To the extent they are relevant, the Comparative Examples—which have at least one characteristic outside of the claimed ranges—disclose copper foils having tensile strengths ranging from 31.4 to 41.5 kgf/mm$^2$ and do not meet the full scope of the claimed range. The specification's repetition of the claim's aspirational language of "30 to 40 kgf/mm$^2$" does not demonstrate possession of, or enable, a copper foil having a tensile strength throughout the entirety of the claimed range. *See, e.g.*, '541 Patent at Abstract, 2:27-28, 4:40-45. The specification does not otherwise disclose how to control the tensile strength such that it could be achieved throughout the entirety of the claimed range.

Further, the specification also fails to disclose or enable a copper foil with a tensile strength of "30 to 40 kgf/mm$^2$" while simultaneously satisfying the other copper foil characteristics explicitly within the scope of the claim that may affect the tensile strength including for example

a "thickness of 1 to 35 μm," as well as the Texture Coefficient Limitation, "a weight deviation of 3% or less," "surface roughness (Rz-JIS) of 2 μm or less" or "elongation of 3 to 20%." For example, in each of the Examples (and Comparative Examples, for that matter), the thickness is held constant at 8 μm and the tensile strength ranges from 32.1-37.2 kgf/mm$^2$. '541 Patent at Table 1. However, claims 1 and 4 encompass copper foils having thicknesses of near-zero μm and 1 μm, respectively, with tensile strengths ranging from 30-40 kg/mm$^2$. *See, e.g.*, PRIOR_ART-00002583 (Influence of Thickness on Tensile Property of Copper Foil, Fujii et al., Key Engineering Materials, vol. 774 (2018)).

**(e) (Claim 1) "so as to prevent the generation of wrinkles at a surface of the copper foil"**

The '541 Patent fails to provide sufficient written description support, or enable, "so as to prevent the generation of wrinkles at a surface of the copper foil" as recited in claim 1. Claim 1 encompasses a genus of copper foils having certain characteristics—including at least four texture coefficient ratios, "a weight deviation of 3% or less," "a tensile strength of 30 to 40 kgf/mm$^2$," "a surface roughness (Rz-JIS) of 2 μm or less," "elongation of 3 to 20%," "and "a thickness of 1 to 35 μm"—but the specification fails to provide a sufficient disclosure to permit a person of ordinary skill to make and use the full scope of the claims and create copper foil "so as to prevent the generation of wrinkles at a surface of the copper foil" without undue experimentation. As an initial matter, the patentee amended claim 1 to recite "so as to prevent the generation of wrinkles at a surface of the copper foil" during prosecution and thus this limitation, alone and in combination with the claim elements, is not supported by the original written description. 2016/02/18 Applicant Response (SKN-0001767 at -2332).

The amendment to claim 1 requiring "so as to prevent the generation of wrinkles at a surface of the copper foil" is not supported by the original written description or enabled, and is

invalid, at least because claim 1 omits numerous other characteristics that the specification describes as material to the presence of wrinkles including for example thickness, as well as surface roughness and elongation. *See, e.g.*, '541 Patent at 2:5-10 ("Another object of the present invention is to provide a copper foil for a current collector of a lithium secondary battery, wherein factors such as surface roughness, weight deviation, tensile strength, elongation, and thickness are optimized so as to effectively decrease the generation of wrinkles at a surface of the copper foil."), 2:31-36, 3:3-7 ("A copper foil for a current collector of a lithium secondary battery according to the present invention gives surface characteristics in which factors such as crystal structure, surface roughness, weight deviation, tensile strength and elongation are optimized not to generate a wrinkle."), 3:51-4:3, 4:26-30, 4:40-45, Table 1, 5:16-35. All seven Examples in Table 1 "of the present invention" purportedly "satisfy ***all*** conditions of the texture coefficient ratio, the tensile strength, the weight deviation and the copper foil thickness, so no wrinkle occurs." *Id.* at 5:17-20. However, when the applicant amended the claims to require "so as to prevent the generation of wrinkles at a surface of the copper foil," it omitted any requirement as to the thickness of the proper foil, surface roughness or elongation. *See, e.g.*, '541 Patent at claim 1; 2016/02/18 Applicant Response at 16-18 (SKN-0001767 at -2346-2348) ("Wrinkles are not generated at the surface of the copper foil only when all conditions of the texture coefficient ratio, the tensile strength and the weight deviation, defined in Claim 1 of this application are satisfied."); PRIOR_ART-00002647 (U.S. Patent No. 8,349,518) (parent to '541 Patent wherein claim 1 recites limitations directed to crystal structure, surface roughness, weight deviation, tensile strength, elongation and thickness). By omitting these requirements from the claim 1, the applicant improperly broadened the claims beyond the scope of the original disclosure. *See, e.g., Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473 (Fed. Cir. 1998) (holding claim invalid where it was directed to a sectional sofa that did

not limit the location of the controls of the softa to be on a console where the specification only described the controls being on the console).

To the extent the Asserted Claims recite characteristics that the specification describes as affecting the presence of wrinkles (e.g., (claim 1) texture coefficient ratios, weight deviation, tensile strength; (claim 2) surface roughness (R-JIS); (claim 3) elongation; (claim 4) thickness), the specification fails to adequately describe the full scope of those ranges as discussed above with respect to the "General Issues." *See*, *e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2011); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2022). The small number of Examples and Comparative Examples (seven and nine, respectively) do not sufficiently describe or enable how to prevent wrinkles throughout the full scope of the claimed ranges.

For example, whereas claim 1 purports to encompass "so as to prevent the generation of wrinkles at a surface of the copper foil" without including an explicit limitation as to thickness (and claim 4 recites a broad range of 1 to 35 μm), all seven Examples (having no wrinkles) and all nine Comparative Examples (having wrinkles) have the same thickness of 8 μm, as shown in Table 1 below:

TABLE 1

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Copper foil | Electrodeposited copper foil | | | | | | | | | | | | | | | |
| Thickness of copper foil [μm] | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| (111) + (200) ratio [%] | 76 | 62 | 83 | 70 | 72 | 81 | 66 | 64 | 73 | 62 | 83 | 87 | 57 | 80 | 75 | 76 |
| (111) ratio [%] | 26 | 31 | 32 | 20 | 35 | 22 | 36 | 16 | 41 | 37 | 19 | 34 | 26 | 30 | 23 | 25 |
| (200) ratio [%] | 50 | 31 | 51 | 50 | 36 | 59 | 30 | 48 | 32 | 25 | 64 | 53 | 31 | 49 | 51 | 50 |
| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |
| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |
| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |
| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |

*See* '541 Patent at Table 1. The specification fails to provide any Examples or Comparative Examples of copper foils having other thicknesses notwithstanding its repeated assertions that copper foil thickness affects the presence of wrinkles. *See, e.g.*, '541 Patent at 2:5-10, 2:31-36, 3:3-7, 3:51-4:3, 4:26-30, 4:40-45, 5:16-35. Further, the prior art cited during prosecution as well as other Asserted Patents describe challenges with preventing wrinkles at low thicknesses. *See, e.g.*, PRIOR_ART-00002612 (U.S. Patent No. 10,377,110) at 5:6-13 ("On the other hand, when the copper foil and the polyimide film are thinner, there may be formed wrinkles in a part contacting a roller during the lamination step for preparing a long copper-clad laminate, leading to a reduced yield due to defective appearance after lamination. Particularly, when using a thin polyimide film having a thickness of 25 μm or less, it is difficult to continuously manufacture a copper-clad laminate in the light of feeding properties."); '689 Patent at 1:63-2:3 ("Also, an electrolytic copper foil having a thickness of 10 μm or less, which is generally used for manufacturing an anode of a lithium secondary battery, is particularly vulnerable to curling or

wrinkling, and the curling or wrinkling of the electrolytic copper foil not only makes handling of the electrolytic copper foil difficult but also makes it impossible to coat the electrolytic copper foil with an active material."), 6:55-59 ("When the thickness of the electrolytic copper foil 110 is less than 4 μm, wrinkles are easily caused and workability of the process of manufacturing the secondary battery is lowered."). The '541 Patent does not explain how it overcame these alleged challenges.

As another example, the '689 Patent provides that elongation values over 10% create a "high risk of wrinkling due to the ease of deformation of the electrolytic copper foil 110 caused by the tension applied to the electrolytic copper foil 110 during the roll-to-roll process for manufacturing the secondary battery." '689 Patent at 6:5-11. Yet, claim 1 includes no limitation as to elongation whereas dependent claim 3 encompasses elongation values above 20%, further showing that at the time of the '541 Patent this limitation was not supported by the written description or enabled.

As another example, the specification fails to disclose the surface roughness and the elongation of the Examples and Comparative Examples, notwithstanding that it identifies these characteristics as affecting the presence of wrinkles. *See, e.g.*, '541 Patent at 2:5-10, 3:3-7.

The specification does not otherwise disclose the relationship between all of the characteristics it describes (or their combination) and the presence of wrinkles, leaving it to a person of ordinary skill to rely on undue experimentation to determine how to prevent wrinkles for copper foils having characteristics throughout the claimed ranges. Thus, the specification does not sufficiently disclose or enable how to prevent wrinkles throughout the full scope of the claimed ranges, forcing a person of ordinary skill in the art to rely on undue experimentation.

SKN's other Asserted Patents further demonstrate that the inventors of the '541 Patent

were not in possession of "so as to prevent the generation of wrinkles at a surface of the copper foil" and that undue experimentation would have been required to prevent the generation of wrinkles at a surface of the copper foil. For example, the '014 Patent suggests that additional characteristics beyond those required by claim 1 of the '541 Patent or disclosed in its specification affect the presence of wrinkles:

TABLE 3

| | DETA (mg/L) | Lateral deviation in flow speed (%) | Binding coefficient (BC) | Texture coefficient of (200) plane | Weight deviation (%) | Yield strength ($kgf/mm^2$) | Adhesion force (N/m) | Wrinkles |
|---|---|---|---|---|---|---|---|---|
| Example 1 | 7.5 | 5.2 | 1.5 | 0.89 | 1.5 | 35 | 28.8 | No wrinkles |
| Example 2 | 7.5 | 5.3 | 9.4 | 0.89 | 1.5 | 35 | 29.5 | No wrinkles |
| Example 3 | 3.2 | 4.8 | 5.2 | 0.49 | 1.5 | 22 | 29.7 | No wrinkles |
| Example 4 | 12 | 5.5 | 5.2 | 1.28 | 1.5 | 49 | 31.2 | No wrinkles |
| Example 5 | 7.5 | 9.8 | 5.2 | 0.89 | 3 | 35 | 25.4 | No wrinkles |
| Comparative Example 1 | 7.7 | 4.8 | 1.3 | 0.89 | 1.5 | 35 | 18.5 | No wrinkles |
| Comparative Example 2 | 7.5 | 5.0 | 9.6 | 0.89 | 1.5 | 35 | 20.1 | No wrinkles |
| Comparative Example 3 | 2.9 | 5.2 | 5.2 | 0.48 | 1.5 | 20 | 18.8 | Wrinkles |
| Comparative Example 4 | 12.1 | 5.3 | 5.2 | 1.3 | 1.5 | 51 | 19.5 | Wrinkles |
| Comparative Example 5 | 7.5 | 11.2 | 5.2 | 0.89 | 3.2 | 35 | 19.8 | No wrinkles |

'014 Patent at Table 3; *see also, e.g.*, *id.* at 6:38-41 ("In the case in which the yield strength of the copper foil is less than 21 $kgf/mm^2$, the copper foil may easily wrinkle due to the force applied to the copper foil during the manufacturing process."). The '689 Patent further purports to identify other characteristics that affect the presence of wrinkles:

TABLE 2

| | Coefficient of Thermal Expansion [μm/(m · ° C.)] | Tensile Strength after Heat Treatment (kgf/mm$^2$) | Weight Deviation (%) | Elongation (%) | Presence of Wrinkle | Breakage of Anode after 500 Cycles of Charging and Discharging |
|---|---|---|---|---|---|---|
| Example 1 | 20.9 | 25.6 | 3.8 | 5.6 | X | X |
| Example 2 | 20.3 | 27.2 | 3.6 | 5.3 | X | X |
| Example 3 | 21.8 | 22.1 | 0.7 | 8.9 | X | X |
| Example 4 | 17.3 | 34.5 | 0.6 | 4.8 | X | X |
| Comparative Example 1 | 22.4 | 22.2 | 3.8 | 10.3 | ○ | X |
| Comparative Example 2 | 15.7 | 35.8 | 3.8 | 2.8 | X | ○ |
| Comparative Example 3 | 22.8 | 20.5 | 0.6 | 10.8 | ○ | X |
| Comparative Example 4 | 15.3 | 36.8 | 0.6 | 2.6 | X | ○ |
| Comparative Example 5 | 20.1 | 26.5 | 5.2 | 5.3 | ○ | X |
| Comparative Example 6 | 21.2 | 27.2 | 5.8 | 5.6 | ○ | X |

'689 Patent at Table 2; *see also, e.g., id.* at 5:45-53 ("On the other hand, when the coefficient of thermal expansion is more than 22 μm/(m· 0C.), curling and/or wrinkling of the electrolytic copper foil 110 is caused by heat received during the manufacturing process of the lithium secondary battery, which not only makes handling of the electrolytic copper foil difficult but also makes it impossible to coat the electrolytic copper foil 110 with the active material when manufacturing the secondary battery electrode 100.").

In addition, if "so as to prevent wrinkles" limitation is construed to allow more than zero wrinkles, it is not supported by the written description or enabled. The specification does not purport to disclose any embodiments having wrinkles.

**(f) (Claim 2) "a surface roughness (Rz-JIS) of 2 μm or less"**

The '541 Patent fails to provide sufficient written description support, or enable, "a surface

roughness (Rz-JIS) of 2 μm or less" as recited in claim 2 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not disclose a copper foil having a surface roughness (Rz-JIS) throughout the entirety of the claimed range of 0 μm and 2 μm, including the low end of the range greater than or equal to 0 μm. In fact, the specification does not disclose the surface roughness of any particular copper foil samples including the copper foils described in Table 1. At best, the specification repeats the claim's aspirational language of "2 μm or less," without purporting to describe any actual copper foil having a surface roughness between 0 μm and 2 μm. *See, e.g.*, '541 Patent at Abstract, 2:23-24, 4:20-25. The specification does not otherwise disclose how to control the surface roughness such that it could be achieved near the low end of the claimed range.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 2, which depends on and further limits claim 1.

**(g) (Claim 4) "thickness of 1 to 35 μm"**

The '541 Patent fails to provide sufficient written description support, or enable, a "thickness of 1 to 35 μm" as recited in claim 4, including in combination with the other properties within the scope of claim 1 from which claim 4 depends. For example, in each of the Examples and Comparative Examples in Table 1, the copper foil thickness is held constant at 8 μm. However, the Asserted Claims recite additional properties—including, for example, (claim 1)

"tensile strength of 30 to 40 kgf/mm2," "weight deviation of 3% or less" and "so as to prevent the generation of wrinkles at a surface of the copper foil"; (claim 2) "surface roughness (Rz-JIS) or 2 μm or less" and (claim 3) "elongation of 3 to 20%" which are not sufficiently disclosed or enabled across the range of thicknesses within the scope of the claim.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 4, which depends on and further limits claim 1.

**1. '090 Patent**

The Asserted Claims of the '090 Patent are invalid because they fail to satisfy the written description and enablement requirements of 35 U.S.C. § 112, ¶ 1. The Asserted Claims fail to satisfy the written description requirement because the written description does not reasonably convey to persons of ordinary skill in the art that the alleged inventors had possession of the full scope of the claimed subject matter as of the effective filing date of the patent. *See, e.g., Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In addition, the Asserted Claims fail to satisfy the enablement requirement because, as of the effective filing date of the patent, a person of ordinary skill in the art could not practice their full scope without undue experimentation. *See, e.g., Wyeth & Cordis Corp. v. Abbott Lab'ys*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The Asserted Claims fail to satisfy the written description and enablement requirement for at least the following exemplary reasons discussed below.

**(a) (Claim 2) "wherein a difference in peak count roughness Rpc between the first and second surfaces is 60 or less"**

The '090 Patent fails to provide sufficient written description support, or enable, "a difference in peak count roughness Rpc between the first and second surfaces is 60 or less" as recited in claim 2 at least because the written description does not show that the inventors were in

possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe copper foils having a difference in peak count roughness Rpc between the first and second surfaces is 60 or less, including the low end of the range equal or nearly equal to 0. For example, in the Examples of Tables 1 and 2, the difference in Rpc ranges from 4 to 59. To the extent they are relevant, the Comparative Examples in Tables 1 and 2—which have at least one characteristic outside of the claimed ranges—disclose copper foils having differences in Rpc ranging from 1 to 134 and do not meet the full scope of the claimed range. The specification's repetition of the claim's aspirational language of "3% or less" does not demonstrate possession of, or enable, a copper foil having a weight deviation at the low end of the claimed range. *See, e.g.*, '090 Patent at 5:56-64. The specification does not otherwise disclose how to control the surface roughness such that it could be achieved near the low end of the range. Although it discloses that "in order for the shiny surface 111a to have a peak count roughness Rpc . . . the surface of the rotational anode drum is polished with a #800 and #1500 grit polishing brush," it does not disclose how to control both surfaces to have an identical or nearly identical Rpc values to result in a difference in Rpc of zero or near-zero.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 2, which depends on and further limits claim 1.

**(b) (Claim 3) "wherein each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less"**

The '090 Patent fails to provide sufficient written description support, or enable, "each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less" as recited in claim 3 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 3, which depends on and further limits claim 1.

**(c) (Claim 4) "wherein the electrolytic copper foil has a thickness of 3 to 20 μm and tensile strength of 30 to 60 kgf/mm$^2$"**

The '090 Patent fails to provide sufficient written description support, or enable, "the electrolytic copper foil has a thickness of 3 to 20 μm and tensile strength of 30 to 60 kgf/mm$^2$" as recited in claim 4 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe or enable copper foils having a tensile strength of 30 to 60 kgf/mm$^2$ throughout the entirety of the claimed ranges of thicknesses (3 to 20 μm) such as, for example, a copper foil having a tensile strength of 60 kgf/mm$^2$ at a thickness of 3 μm. For example, the specification does not disclose the tensile strength of ***any*** of the disclosed examples in Tables 1 or 2, or elsewhere. The specification's repetition of the claim's aspirational language of "a thickness of 3 to 20 μm and a tensile strength of 30 to 60 kgf/mm$^2$" does not demonstrate possession of, or enable, a copper foil having a tensile strength within the claimed range throughout the claimed range of thicknesses. *See, e.g.*, '090 Patent at 4:11-14. The specification does not otherwise disclose how to control the tensile strength.

Further, the specification fails to disclose or enable a copper foil with a tensile strength of "30 to 40 kgf/mm$^2$" while simultaneously satisfying the other copper foil characteristics explicitly within the scope of the claim that may affect the tensile strength including for example (claim 1) "Rpc of 10 to 100"; (claim 2) "a difference in peak count roughness Rpc between the first and second surfaces is 60 or less"; (claim 3) "each of the first and second surfaces has a ten-point mean roughness RzJIS of 2 μm or less."

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 4, which depends on and further limits claim 1.

**2. '689 Patent**

The Asserted Claims of the '689 Patent are invalid because they fail to satisfy the written description and enablement requirements of 35 U.S.C. § 112, ¶ 1. The Asserted Claims fail to satisfy the written description requirement because the written description does not reasonably convey to persons of ordinary skill in the art that the alleged inventors had possession of the full scope of the claimed subject matter as of the effective filing date of the patent. *See, e.g., Ariad*

*Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In addition, the Asserted Claims fail to satisfy the enablement requirement because, as of the effective filing date of the patent, a person of ordinary skill in the art could not practice their full scope without undue experimentation. *See, e.g.*, *Wyeth & Cordis Corp. v. Abbott Lab'ys*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The Asserted Claims fail to satisfy the written description and enablement requirement for at least the following exemplary reasons discussed below.

**(a) (Claim 1) "a weight deviation of the electrolytic copper foil at 5% or less"**

The '689 Patent fails to provide sufficient written description support, or enable, "a weight deviation of the electrolytic copper foil at 5% or less" as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe copper foils having a weight deviation throughout the entirety of the claimed range between 0 and 5%, including the low end of the range greater than or equal to 0% and less than 0.6%. For example, in the Examples of Table 2, the weight deviation ranges from 0.6 to 3.8%. '689 Patent at Table 2. To the extent they are relevant, the Comparative Examples—which have at least one characteristic outside of the claimed ranges—disclose copper foils having weight deviations ranging from 0.6% to 5.8% and do not meet the full scope of the claimed range. '689 Patent at Table 1. The specification's repetition of the claim's aspirational

language of "5% or less" does not demonstrate possession of, or enable, a copper foil having a weight deviation at the low end of the claimed range. *See, e.g.*, '689 Patent at Abstract, 2:27-42, 2:55-3:5, 6:16-30, 9:24-33; *see also id.* at 6:31-36, 13:14-22. The specification's disclosure of steps that may be used "in order for the electrolytic copper foil 110 to have a weight deviation of 5% or less" similarly does not include any description of how to achieve a weight deviation near the lower end of the range. '689 Patent at 9:24-33 ("According to the present invention, in order for the electrolytic copper foil 110 to have a weight deviation of 5% or less, while the electroplating is performed, an interval between the positive electrode plate and the rotating negative electrode drum is maintained to be in a range of 5 to 15 mm, and a difference between a maximum interval and a minimum interval of the positive electrode plate and the rotating negative electrode drum according to a width direction of the copper layer 111 is maintained to be less than 0.2 mm.").

The applicant of the '541 Patent admitted during prosecution that it would be challenging for a person of ordinary skill in the art to create a copper foil having a low weight deviation. In particular, during prosecution of the '541 Patent, the applicant acknowledged that "a weight deviation inevitably occurs in the width or length direction of the copper foil, and generally the weight deviation is great"; that "there is no copper foil in which the weight deviation is 0" and that "it is not easy to reduce the weight deviation." 2016/02/18 Applicant Response (SKN-0001767 at -2346-2348).

The specification of the '689 Patent also fails to disclose or enable a copper foil with a weight deviation at the low end of the "5% or less" range while simultaneously satisfying other copper foil characteristics that are within the scope of the claim and that may affect the weight deviation such as, for example, (claim 4) "thickness of 4 to 30 μm." In fact, the specification does not disclose the thickness of any particular copper foil samples including the copper foils described

in Tables 1 and 2. At best, the specification repeats claim 4's aspirational language of "4 to 30 μm," without purporting to describe any actual copper foil having a thickness within that range. *E.g.*, '689 Patent at 2:50, 6:54-61. Further, the specification acknowledges challenges in creating copper foils at thicknesses below 4 μm and greater than 30 μm. *E.g.*, *id.* at 1:63-2:3, 6:54-61. Further, for foils with very small thicknesses, inconsistencies in manufacturing would have more pronounced effects on weight deviation, and it would require undue experimentation for a person of ordinary skill to create a copper foil having a weight deviation near zero percent. Conversely, foils with large thicknesses may have more pronounced inconsistencies in manufacturing, and it would require undue experimentation for a person of ordinary skill to create a copper foil having a weight deviation near zero percent. Yet, claim 1 includes no limitation as to thickness, and the applicant sought to encompass all foils of any thickness even though the specification does not show possession of or enable them.

**(b) (Claim 1) "a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92"**

The '689 Patent fails to provide sufficient written description support, or enable, "a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 9" as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012).

The specification does not describe copper foils having a peak count throughout the entirety of the claimed range of "3 to 92." In fact, the specification does not disclose the peak count of any particular copper foil samples including the copper foils described in Tables 1 and 2. At best, the specification repeats the claim's aspirational language of "3 to 92," without purporting to describe

any actual copper foil having a peak count within that range. *See, e.g.*, '689 Patent at 2:45-46, 7:60-64, 8:61-65. Further, the specification's disclosure that "[t]he peak count (Pc) and the surface roughness (Rz) of each of the first and second surfaces S1 and S2 of the electrolytic copper foil 110 may be respectively controlled to be 3 to 92 and 3.5 μm or less by managing each of TOC and the concentration of silver (Ag) within the above ranges" does not explain how to control these aspects to result in a copper foil having the claimed characteristics, requiring a person of ordinary skill to perform undue experimentation to achieve them. *Id.* at 8:61-65.

**(c) (Claim 2) "elongation of 3% or more at room temperature"**

The '689 Patent fails to provide sufficient written description support, or enable, "elongation of 3% or more at room temperature" as recited in claim 2 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe copper foils having an elongation throughout the entirety of the claimed range of "3% or more at room temperature," including for example elongations between 3% and 4.8%, or elongations greater than 12% such as, for example, 15%, 25%, 50%, 75%, 100%, 200% or more. For example, in the Examples of Table 1, the elongation ranges from 4.8% to 8.9%. '689 Patent at Table 2. To the extent they are relevant, the Comparative Examples—which have at least one characteristic outside of the claimed ranges—disclose copper foils having elongations ranging from 2.6% to 10.8% and do not meet the full scope of the claimed range. The specification's repetition of the claim's aspirational language of "3% or more" does

not demonstrate possession of, or enable, a copper foil having an elongation throughout the entirety of the claimed range. *See, e.g.*, '689 Patent at 2:43-44, 6:37-39. The specification does not otherwise disclose how to control elongation such that it could be achieved throughout the entirety of the claimed range.

**3. '014 Patent**

The Asserted Claims of the '014 Patent are invalid because they fail to satisfy the written description and enablement requirements of 35 U.S.C. § 112, ¶ 1. The Asserted Claims fail to satisfy the written description requirement because the written description does not reasonably convey to persons of ordinary skill in the art that the alleged inventors had possession of the full scope of the claimed subject matter as of the effective filing date of the patent. *See, e.g., Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In addition, the Asserted Claims fail to satisfy the enablement requirement because, as of the effective filing date of the patent, a person of ordinary skill in the art could not practice their full scope without undue experimentation. *See, e.g., Wyeth & Cordis Corp. v. Abbott Lab'ys*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The Asserted Claims fail to satisfy the written description and enablement requirement for at least the following exemplary reasons discussed below.

**(a) (Claim 1) Binding Coefficient Limitation**

The '014 Patent fails to provide sufficient written description support, or enable, "a binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient=Rp/μm+ peak density/30+ amount of attachment of Cr/(mg/m2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of ±0.5 μm and wherein the amount of

attachment of Cr (mg/m2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer)" recited in claim 1.

**(b) (Claim 2) Texture Coefficient Limitation**

The '014 Patent fails to provide sufficient written description support, or enable, "an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, 0.49 to 1.28 [*sic*],

$$TC(220) = \frac{\frac{I(220)}{I_0(220)}}{\frac{1}{n}\sum \frac{I(hkl)}{I_0(hkl)}} \qquad \text{(Mathematical Expression 2)}$$

wherein TC(220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 θ), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes," as recited in claim 2 (hereinafter "Texture Coefficient Limitation").

The specification describes in the disclosed Examples and Comparative Examples within Table 3 copper foils with certain texture coefficients of (220) plane without sufficiently explaining how to make foils throughout the full scope of the claimed ranges. '014 Patent at Table 3. For example, the specification only purports to disclose a limited number of ways to obtain texture coefficient of a (220) plane by controlling "the concentration of the nitride-based

compound" in the plating solution to meet this limitation, while identifying certain broad ranges of plating conditions, without explaining how the conditions affect the texture coefficients or other characteristics required by the claims:

> [I]n the case in which the concentration of a nitride-based compound in the plating solution exceeds 12 ppm, micro-scale plating is performed, and the texture of the (220) plane develops. In the case in which the concentration of the nitride-based compound in the plating solution is less than 3 ppm, on the other hand, the size of a plated grain is large, the texture of the (111) plane develops, and the texture of the (220) plane is relatively inhibited.
>
> In the present disclosure, the electrolytic solution 20 is preferably maintained at 50 to 60° C., and the flow rate of the electrolytic solution 20 that is supplied into the electrolytic bath 10 is preferably maintained at 35 to 46 $m^3$/hour.

*Id*. at 8:39-50.

Claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 2, which depends on and further limits claim 1.

**(c) (Claim 3) "a weight deviation in lateral direction of the electrolytic copper foil is less than 3%"**

The '014 Patent fails to provide sufficient written description support, or enable, "a weight deviation in lateral direction of the electrolytic copper foil is less than 3%" as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012). Further, a person of ordinary skill in the art would not have recognized there to be an inherent limit to the range. To the extent SKN contends that there is an inherent limit, the written description would not sufficiently describe or enable the range to that limit.

The specification does not describe copper foils having a weight deviation throughout the entirety of the claimed range between 0 and 3%, including the low end of the range greater than or equal to 0% and less than 1.5%. For example, in the Examples of Table 2, the weight deviation ranges from 1.5 to 3%:

TABLE 3

| | DETA (mg/L) | Lateral deviation in flow speed (%) | Binding coefficient (BC) | Texture coefficient of (200) plane | Weight deviation (%) | Yield strength ($kgf/mm^2$) | Adhesion force (N/m) | Wrinkles |
|---|---|---|---|---|---|---|---|---|
| Example 1 | 7.5 | 5.2 | 1.5 | 0.89 | 1.5 | 35 | 28.8 | No wrinkles |
| Example 2 | 7.5 | 5.3 | 9.4 | 0.89 | 1.5 | 35 | 29.5 | No wrinkles |
| Example 3 | 3.2 | 4.8 | 5.2 | 0.49 | 1.5 | 22 | 29.7 | No wrinkles |
| Example 4 | 12 | 5.5 | 5.2 | 1.28 | 1.5 | 49 | 31.2 | No wrinkles |
| Example 5 | 7.5 | 9.8 | 5.2 | 0.89 | 3 | 35 | 25.4 | No wrinkles |
| Comparative Example 1 | 7.7 | 4.8 | 1.3 | 0.89 | 1.5 | 35 | 18.5 | No wrinkles |
| Comparative Example 2 | 7.5 | 5.0 | 9.6 | 0.89 | 1.5 | 35 | 20.1 | No wrinkles |
| Comparative Example 3 | 2.9 | 5.2 | 5.2 | 0.48 | 1.5 | 20 | 18.8 | Wrinkles |
| Comparative Example 4 | 12.1 | 5.3 | 5.2 | 1.3 | 1.5 | 51 | 19.5 | Wrinkles |
| Comparative Example 5 | 7.5 | 11.2 | 5.2 | 0.89 | 3.2 | 35 | 19.8 | No wrinkles |

'014 Patent at Table 2. To the extent they are relevant, the Comparative Examples—which have at least one characteristic outside of the claimed ranges—disclose copper foils having weight deviations ranging from 1.5% to 3.2% and do not meet the full scope of the claimed range. *Id.* The specification's repetition of the claim's aspirational language of "less than 3%" does not demonstrate possession of, or enable, a copper foil having a weight deviation at the low end of the claimed range. *See, e.g.*, *Id.* at 2:41-42, 6:10-12.

The specification's disclosure of manufacturing processes that may cause weight deviation to exceed 3% does not describe or enable how to achieve a weight deviation at the low end of the range. For example, the specification's disclosure that "[i]n the case in which the weight deviation in lateral direction is 3% or more, coating is nonuniformly performed at the time of coating the

copper foil with the negative electrode material, and the copper foil is thinly coated with the negative electrode material in an area having small weight at the point at which the weight deviation of the copper foil is great, whereby a separation phenomenon may easily occur," does not explain how to control weight deviation to achieve values at the low end of the range. *Id.* at 6:13-20. Similarly, the specification's disclosures regarding supplying the electrolytic solution and flow speed, reproduced below, do not explain how to achieve a weight deviation near the low end of the range:

> In the present disclosure, the electrolytic solution 20 is preferably maintained at 50 to 60° C., and the flow rate of the electrolytic solution 20 that is supplied into the electrolytic bath 10 is preferably maintained at 35 to 46 m3/hour. In the case in which the flow rate of the electrolytic solution 20 is less than 35 m3/hour, copper ions are not sufficiently supplied to the surface of the rotary negative electrode drum 40, whereby a plated thin foil is nonuniformly formed. In the case in which the flow rate of the electrolytic solution 20 exceeds 46 m3/hour, the flow speed of the electrolytic solution 20 that passes through a filter is too high whereby the lifespan of the filter is abruptly shortened.
>
> In the foil making process of the present disclosure, deviation in flow speed must be maintained within 10%. In the case in which deviation in flow speed is 10% or more, solution resistance is low at the portion at which flow speed is high, whereby the amount of plating of Cu increases, and solution resistance is high at the portion at which flow speed is low, whereby the amount of plating of Cu relatively decreases. As a result, the weight deviation in lateral direction of the finally plated copper foil exceeds 3%.

*Id.* at 8:59-67.

The applicant of the '541 Patent admitted during prosecution that it would be challenging for a person of ordinary skill in the art to create a copper foil having a low weight deviation. In particular, during prosecution of the '541 Patent, the applicant acknowledged that "a weight deviation inevitably occurs in the width or length direction of the copper foil, and generally the weight deviation is great"; that "there is no copper foil in which the weight deviation is 0" and that "it is not easy to reduce the weight deviation." 2016/02/18 Applicant Response at 16-18 (SKN-0001767 at -2346-2348).

The specification of the ’014 Patent also fails to disclose or enable a copper foil with a weight deviation at the low end of the “less than 3%” range while simultaneously satisfying other copper foil characteristics that are within the scope of the claims 1 and 3. For example, claims 1 and 3 do not include an explicit claim limitation as to thickness or disclose a copper foil with a low thickness, or a high thickness, with a weight deviation near the low end of the claimed range. The specification’s statement that “[i]n the present disclosure, the electrolytic copper foil 110 has a predetermined thickness, e.g. a thickness of 4 to 30 μm,” ’014 Patent at 3:57-58, does not explain to make a foil having a low weight deviation throughout the entirety of thicknesses within the scope of the claim. Further, the specification disclosure that “an electrolytic copper foil having a thickness of 6 μm was manufactured,” *id.* at 9:44-49, likewise does not explain to make a foil having a low weight deviation throughout the entirety of thicknesses within the scope of the claim. The specification’s description of issues with respect to copper foils less than 4 μm or greater than 30 μm likewise does not explain how to make a copper foil having a weight deviation at the low end of the claimed range within the scope of thicknesses permitted by the claims. *Id.* at 1:57-64. (“In the case in which the thickness of the copper foil is less than 4 μm, workability is deteriorated in a battery manufacturing process. In the case in which the thickness of the copper foil is greater than 30 μm, it is difficult to realize high capacity at the time of manufacturing an Li secondary battery due to the large thickness of the copper foil.”). Further, for foils with very small thicknesses, inconsistencies in manufacturing would have more pronounced effects on weight deviation, and it would require undue experimentation for a person of ordinary skill to create a copper foil having a weight deviation near zero percent. Conversely, foils with large thicknesses may have more pronounced inconsistencies in manufacturing, and it would require undue experimentation for a person of ordinary skill to create a copper foil having a weight deviation

near zero percent. Yet, claim 1 includes no limitation as to thickness, and the applicant sought to encompass all foils of any thickness even though the specification does not show possession of or enable them.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 3, which depends on and further limits claim 1.

**(d) (Claim 4) "yield strength of 21 to 49 kgf/mm$^2$ measured at a normal temperature"**

The '014 Patent fails to provide sufficient written description support, or enable, "yield strength of 21 to 49 kgf/mm$^2$ measured at a normal temperature" as recited in claim 4 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g., Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012).

The specification does not describe copper foils having yield strength throughout the entirety of the claimed range of "21 to 49 kgf/mm$^2$" while simultaneously satisfying other copper foil characteristics that are within the scope of the claim. For example, in the Examples of Table 3 the lowest yield strength is 22 kgf/mm$^2$. '541 Patent at Table 3. While one of the Comparative Examples has a yield strength of 20 kgf/mm$^2$, it does not meet other requirements of the claims such as, for example, the texture coefficient requirement (specifically, Comparative Example 3 has a texture coefficient of 0.48 and a yield strength of 20 kgf/mm$^2$). The specification's repetition of the claim's aspirational language of "21 to 49 kgf/mm$^2$" does not demonstrate possession of, or enable, a copper foil having a yield strength throughout the entirety of the claimed range. *See, e.g.*, '014 Patent at 2:41-44, 6:35-38. Further, the specification's description of issues with foils

having a yield strength below 21 or above 49 kgf/mm$^2$ does not explain how to make a foil having a yield strength within the claimed range while simultaneously satisfying the other claim requirements. *Id.* at 6:38-47.

Further, the specification only purports to disclose a limited number of ways to control the yield strength by adjusting "the content of a nitride in the electrolytic solution" while identifying certain broad ranges of plating conditions, without explaining how the conditions affect the yield strength or other characteristics required by the claims:

> Specifically, the content of a nitride in the electrolytic solution may be adjusted to control the yield strength and adhesion force of the copper foil. In the present disclosure, at least oen nitride selected from the group consisting of diethylenetriamine (DETA), thiourea, gelatin, collagen, glycine, glycogen, polyacrylamide, and propyl amide may be used as a preferred nitride. For example, a range of appropriate concentration of DETA. . . is 3.2 to 12.0 ppm. . . In the present disclosure, the electrolytic solution 20 is preferably maintained at 50 to 60° C., and the flow rate of the electrolytic solution 20 that is supplied into the electrolytic bath 10 is preferably maintained at 35 to 46 m$^3$/hour.

*Id*. at 8:26-56.

Further, claim 1 is invalid for failure to satisfy the written description and enablement requirements for at least the same reasons because its scope is broader than that of claim 4, which depends on and further limits claim 1.

**4. '706 Patent**

The Asserted Claims of the '706 Patent are invalid because they fail to satisfy the written description and enablement requirements of 35 U.S.C. § 112, ¶ 1. The Asserted Claims fail to satisfy the written description requirement because the written description does not reasonably convey to persons of ordinary skill in the art that the alleged inventors had possession of the full scope of the claimed subject matter as of the effective filing date of the patent. *See, e.g., Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). In addition, the Asserted Claims fail to satisfy the enablement requirement because, as of the effective filing date of the

patent, a person of ordinary skill in the art could not practice their full scope without undue experimentation. *See, e.g.*, *Wyeth & Cordis Corp. v. Abbott Lab'ys*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The Asserted Claims fail to satisfy the written description and enablement requirement for at least the following exemplary reasons discussed below.

**(a) (Claim 1) Texture Coefficient of (220) Plane**

The '706 Patent fails to provide sufficient written description support, or enable, "wherein a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,

$$TC(220) = \frac{\frac{I(220)}{I_0(220)}}{\frac{1}{n}\sum \frac{I(hkl)}{I_0(hkl)}} \qquad \text{(Equation 1)}$$

,,

as recited in claim 1 at least because the written description does not show that the inventors were in possession of the full scope of the claimed range, or permit a person of ordinary skill in the art to achieve the full scope of the range without undue experimentation. *See, e.g.*, *Indivior*, 18 F.4th at 1328-30 (Fed. Cir. 2021); *MagSil*, 687 F.3d at 1383-84 (Fed. Cir. 2012).

For example, the specification fails to disclose or enable a copper foil texture coefficient of (220) plane within the full scope of the claimed range. The specification describes in the disclosed Examples and Comparative Examples within Table 2 copper foils with certain texture coefficients of (220) plane without sufficiently explaining how to make foils throughout the full scope of the claimed ranges. '706 Patent at Table 2. Indeed, the specification fails to describe the composition or manufacturing process of each of the Examples or Comparative Examples.

As another example, independent claim 1 of the '706 Patent recites an electrolytic copper foil with "a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32[.]" '706 Patent at claim 1. The only such electrolytic copper foil

disclosed in the specification is one manufactured using electrolytic solution including an additive that is a "sulfide-based compound selected from the group consisting of bis-(sodium sulfopropyl) disulfide (SPS), 3-mercapto 1-propane sulfonate (MPS), and 3-(benzothiazolyl-2-mercapto)-propyl-sulfonate (ZPS)." *Id*. at 6:5-11. Further, the concentration of such additives in the electrolyte are only disclosed for SPS, including "greater than 12 ppm . . . less than 32 ppm" as a range to be avoided to prevent deviation of the texture coefficient from the preferable upper and lower limits, respectively. *Id*. at 6:13-20. Thus, to the extent the claimed "texture coefficient of (220)" is interpreted to cover anything beyond the disclosed "sulfide-based compound" and concentration of SPS "greater than 12 ppm" and "less than 32 ppm," disclosed in the '706 Patent specification, the specification does not enable or provide sufficient written description support for independent claim 1, and dependent claims 2-5, which depend therefrom.

**(b) (Claim 1) Difference (|Δ(Rz/Ra)|)**

The '706 Patent fails to provide sufficient written description support, or enable, "a difference (|Δ(Rz/Ra)|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42" as recited in claim 1. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

For example, the specification fails to disclose or enable a copper foil with difference (|Δ(Rz/Ra)|) within the full scope of each of the claimed ranges. The specification describes in the disclosed Examples and Comparative Examples within Table 2 copper foils with certain difference (|Δ(Rz/Ra)|) without sufficiently explaining how to make foils throughout the full

scope of the claimed ranges. ’706 Patent at Table 2. Indeed, the specification fails to describe the composition or manufacturing process of each of the Examples or Comparative Examples.

As another example, the specification only purports to disclose a limited number of ways to obtain “a difference (|Δ(Rz/Ra)|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface.” The only such electrolytic copper foil disclosed in the specification is one where the surface of the drum used for manufacture is “buffed using a brush having a grit of 500 # to 3000 #[.]” to control the Rz value. *Id*. at 6:30-45. Thus, to the extent that claimed “difference (|Δ(Rz/Ra)|)” is interpreted to cover any foil meeting those limitations beyond use of a “brush having a grit of 500 # to 3000 #,” disclosed in the ’706 Patent specification, the specification does not enable or provide sufficient written description support for independent claim 1, and dependent claims 2-5, which depend therefrom.

Moreover, the only such electrolytic copper foil disclosed in the specification is one where “the concentration of Mo in the electrolytic solution is maintained at 25 to 50 ppm” to control the Rz value on the M surface. ’541 Patent at 6:49-57. The Rz value of the M surface is claimed to affect the difference (|Δ(Rz/Ra)|) as claimed in claim 1. Thus, to the extent that the claimed “difference (|Δ(Rz/Ra)|)” is interpreted to cover any foil meeting those limitations beyond the control of “the concentration of Mo in the electrolytic solution maintained at 25 to 50 ppm” in the ’706 Patent specification, the specification does not enable or provide sufficient written description support for independent claim 1, and dependent claims 2-5, which depend therefrom.

**(c) (Claim 1) Difference Peak Density**

The ’706 Patent fails to provide sufficient written description support, or enable, “a difference (|ΔPD|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less” as

recited in claim 1. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

For example, the specification fails to disclose or enable a copper foil with difference (|ΔPD|) within the full scope of each of the claimed ranges. The specification describes in the disclosed Examples and Comparative Examples within Table 2 copper foils with certain difference (|ΔPD|) without sufficiently explaining how to make foils throughout the full scope of the claimed ranges. '706 Patent at Table 2. Indeed, the specification fails to describe the composition or manufacturing process of each of the Examples or Comparative Examples.

As another example, independent claim 1 of the '706 Patent claims an electrolytic copper foil with "a difference (|ΔPD|) between a peak density (PD) at the first surface of the of the electrolytic copper foil and a peak density (PD) at the second surface . . . is 96 ea or less." *Id.* at claim 1. The only such electrolytic copper foil disclosed in the specification is one where the surface of the drum used for manufacture is "buffed using a brush having a grit of 500 # to 3000 #[.]" to control the PD on the S surface. *Id*. at 6:30-45. Thus, to the extent that claimed "difference (|ΔPD|)" is interpreted to cover any foil meeting those limitations beyond use of a "brush having a grit of 500 # to 3000 #," disclosed in the '706 Patent specification, the specification does not enable or provide sufficient written description support for independent claim 1, and dependent claims 2-5, which depend therefrom.

Moreover, the only such electrolytic copper foil disclosed in the specification is one where "the concentration of polyethylene glycol (PEG) . . . within the range of 5 to 25 ppm" to control both the PD and Rz values on the M surface. '541 Patent at 7:1-17. The PD value of on

the M surface affects the difference (|Δ(PD)|) as claimed in claim 1. Thus, to the extent that the claimed (|Δ(PD)|) value of "96 ea or less" is interpreted to cover any foil meeting those limitations beyond the control of "the concentration of polyethylene glycol (PEG) . . . within the range of 5 to 25 ppm" in the '706 Patent specification, the specification does not enable or provide sufficient written description support for independent claim 1, and dependent claims 2-5, which depend therefrom.

**(d) (Claim 2) Rz/Ra at the Second Surface**

The '706 Patent fails to provide sufficient written description support, or enable, "[t]he electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.9" as recited in claim 2. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

For example, the specification fails to disclose or enable a copper foil with Rz/Ra at the second surface within the full scope of each of the claimed ranges. The specification describes in the disclosed Examples and Comparative Examples within Table 2 copper foils with certain Rz/Ra values at the second surface without sufficiently explaining how to make foils throughout the full scope of the claimed ranges. '706 Patent at Table 2. Indeed, the specification fails to describe the composition or manufacturing process of each of the Examples or Comparative Examples. Thus, the specification does not enable or provide sufficient written description support for dependent claims 2.

**(e) (Claim 3) Rz/Ra at the First Surface**

The '706 Patent fails to provide sufficient written description support, or enable, "[t]he electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra

at the S surface of the electrolytic copper foil is 5.1 to 6.8" as recited in claim 3. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

For example, the specification fails to disclose or enable a copper foil with Rz/Ra at the first surface within the full scope of each of the claimed ranges. The specification describes in the disclosed Examples and Comparative Examples within Table 2 copper foils with certain Rz/Ra at the first surface without sufficiently explaining how to make foils throughout the full scope of the claimed ranges. '706 Patent at Table 2. Indeed, the specification fails to describe the composition or manufacturing process of each of the Examples or Comparative Examples. Thus, the specification does not enable or provide sufficient written description support for dependent claims 3.

**(f) (Claim 4) Tensile strength of electrolytic copper foil**

The '706 Patent fails to provide sufficient written description support, or enable "[t]he electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm$^2$" as recited in claim 4. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

The specification does not disclose or enable a copper foil with a tensile strength, measured at room temperature, "30 to 65 kgf/mm2" or otherwise disclose how to control tensile strength. For example, the '706 Patent specification fails to describe any copper foils with any

tensile strength in the disclosed Examples and Comparative Examples within Table 2, much less explain how to achieve such tensile strength through the claimed range. '706 Patent at Table 2. Thus, the specification does not enable or provide sufficient written description support for dependent claims 4.

**(g) (Claim 5) Elongation of electrolytic copper foil**

The '706 Patent fails to provide sufficient written description support, or enable, "The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more" as recited in claim 5. A patent must disclose the entirety of a claimed range in order to meet the written description and enablement requirements. *See, e.g., Indivior UK Ltd. v. Dr. Reddy's Labs. S.A.*, 18 F.4th 1323, 1328-30 (Fed. Cir. 2021); *MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1383-84 (Fed. Cir. 2012).

The specification does not disclose or enable a copper foil with an elongation, measured at room temperature, of "3% or more" or otherwise disclose how to control elongation. For example, the '706 Patent specification fails to describe any copper foils with any elongation in the disclosed Examples and Comparative Examples within Table 2, much less explain how to achieve such elongation through the claimed range. '706 Patent at Table 2. Thus, the specification does not enable or provide sufficient written description support for dependent claims 5.

## VI. Invalidity Under 35 U.S.C. § 101

Pursuant to the Court's Standing Order, Defendants contend that the Asserted Claims are invalid under 35 U.S.C. § 101 because the claims are not directed to patent-eligible subject matter. Defendants' contentions that the Asserted Claims are invalid under 35 U.S.C. § 101 do not constitute, and should not be interpreted as, admissions regarding the construction or scope of the

claims of the Asserted Claims, or that any of the Asserted Claims are not anticipated or rendered obvious by the prior art.

35 U.S.C. § 101 provides that "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor[.]" Because abstract ideas form the "basic tools of scientific and technological work," they are unpatentable subject matter under 35 U.S.C. § 101. *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014). "The Supreme Court provided a two-part test for assessing patent eligibility under Section 101." *Certain Elec. Devices, Including Streaming Players, Televisions, Set Top Boxes, Remote Controllers, & Components Thereof*, Inv. No. 337-TA-1200, Order No. 21, 2020 WL 6441422 at *4 (Sept. 14, 2020).

Under the first step of *Alice* ("Step One"), a court must decide whether the claims are directed to ineligible subject matter, such as an abstract idea or natural phenomena. *RecogniCorp, LLC v. Nintendo Co.*, 855 F.3d 1322, 1326 (Fed. Cir. 2017); *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1346 (Fed. Cir. 2015). To do so, a court examines the claims to determine whether their "character as a whole," or their "focus," is an abstract idea or natural phenomena. *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353 (Fed. Cir. 2016). This examination entails "identify[ing] and defin[ing] whatever fundamental concept appears wrapped up" in the claims. *Accenture Glob. Servs., GmbH v. Guidewire Software, Inc.*, 728 F.3d 1336, 1341 (Fed. Cir. 2013) (internal quotation marks and citations omitted). Once ascertained, the court then determines whether that character is "directed to excluded subject matter," such as an abstract idea or natural phenomena. *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335 (Fed. Cir. 2016) (internal citation omitted). This inquiry often asks whether the claims' character is directed to "a specific means or method" for improving technology or whether it is simply directed to an abstract

end-result. *RecogniCorp*, 855 F.3d at 1326. If the claims are not directed to an abstract idea or natural phenomena, the inquiry ends. *Thales Visionix Inc. v. United States*, 850 F.3d 1343, 1349 (Fed. Cir. 2017).

If the claims, as here, are directed to one or more abstract ideas or natural phenomena, then the court advances to the second step of *Alice* ("Step Two"), where the claim elements must be scrutinized "both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application." *Enfish*, 822 F.3d at 1354 (quoting *Alice*, 573 U.S. at 217). At Step Two, the court searches for an "'inventive concept' sufficient to 'transform the nature of the claim into a patent-eligible application.'" *RecogniCorp*, 855 F.3d at 1327 (quoting Alice, 573 U.S. at 217). To save a patent at Step Two, an inventive concept must be evident in the claims. *See Alice*, 573 U.S. at 221; *Synopsys, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1149 (Fed. Cir. 2016). The "inventive concept" must also "involve more than performance of well-understood, routine, and conventional activities previously known to the industry." *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1367 (Fed. Cir. 2018); *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 73 (2012); *Certain Elec. Devices*, 2020 WL 6441422 at *4. The Federal Circuit's "precedent is clear that merely adding computer functionality to increase the speed or efficiency of the process does not confer patent eligibility on an otherwise abstract idea." *Ericsson Inc. v. TCL Commc'n Tech. Holdings Ltd.*, 955 F.3d 1317, 1330 (Fed. Cir. 2020) (citing *Intellectual Ventures I LLC v. Capital One Bank (USA)*, 792 F.3d 1363, 1370 (Fed. Cir. 2015)). In addition, limitations that simply restrict the invention to a single field of use or merely add "token post-solution" requirements also fail to impart patentability. *Bilski v. Kappos*, 561 U.S. 593, 612 (2010).

All Asserted Claims of the '541 Patent are invalid under 35 U.S.C. § 101 because they fail

to claim patent-eligible subject matter. ***First***, the Asserted Claims are directed to natural phenomena and recite natural properties of copper foils. The Asserted Claims, however, fail to describe anything beyond these natural properties. None of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. All of the properties required by the claim were well-known in the art and conventional, as discussed in Appendix A and B. ***Second***, the Asserted Claims are directed to the abstract idea of preventing wrinkles. During prosecution, the Applicant argued that "the subject invention is directed to 'preventing the generation of wrinkles at the surface of the copper foil'" which represents an abstract concept. Further, none of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. Indeed, to overcome a rejection over the prior art, the Applicant amended the claims to recite "so as to prevent the generation of wrinkles at a surface of the coper foil." 2016/02/18 Applicant Response at 15-18 (SKN-0001767 at -2345-2348). All of the properties required by the claim were well-known in the art and conventional, as discussed in Appendix A and B.

All Asserted Claims of the '090 Patent are invalid under 35 U.S.C. § 101 because they fail to claim patent-eligible subject matter. The Asserted Claims are directed to natural phenomena and recite natural properties of copper foils. The Asserted Claims, however, fail to describe anything beyond these natural properties. None of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. All of the properties were well-known in the art and conventional, as discussed in Appendix A and B.

All Asserted Claims of the '689 Patent are invalid under 35 U.S.C. § 101 because they fail

to claim patent-eligible subject matter. The Asserted Claims are directed to natural phenomena and recite natural properties of copper foils. The Asserted Claims, however, fail to describe anything beyond these natural properties. None of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. All of the properties were well-known in the art and conventional, as discussed in Appendix A and B.

All Asserted Claims of the ’014 Patent are invalid under 35 U.S.C. § 101 because they fail to claim patent-eligible subject matter. The Asserted Claims are directed to natural phenomena and recite natural properties of copper foils. The Asserted Claims, however, fail to describe anything beyond these natural properties. None of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. All of the properties were well-known in the art and conventional, as discussed in Appendix A and B.

All Asserted Claims of the ’706 Patent are invalid under 35 U.S.C. § 101 because they fail to claim patent-eligible subject matter. The Asserted Claims are directed to natural phenomena and recite natural properties of copper foils. The Asserted Claims, however, fail to describe anything beyond these natural properties. None of the remaining claim elements, considered individually or as an ordered combination, transform the nature of the claims into patent-eligible subject matter. All of the properties were well-known in the art and conventional, as discussed in Appendix A and B.

## VII. Priority Dates

The Asserted Claims of the ’541 Patent are not entitled to the foreign priority date because the foreign priority application does not support the claimed requirement “so as to prevent the

generation of wrinkles at a surface of the copper foil" in combination with the claimed set of copper foil characteristics. Notably, the applicant for the '541 Patent added the requirement of "so as to prevent the generation of wrinkles at a surface of the copper foil" through an amendment during prosecution. 2016/02/18 Applicant Response (SKN-0001767 at -2333). Accordingly, the '541 Patent is not entitled to a priority date before February 17, 2011.

## VIII. Patent L.R. 3-4 – Document Production Accompanying Invalidity Contentions

### A. Documents Related to Accused Instrumentalities Under Patent L.R. 3-4(a)

Based on their investigations to date, Defendants have produced or is producing materials pursuant to Patent L.R. 3-4(a), including the documents produced at Bates Nos. VOLTA_00000019- VOLTA_00002221.

### B. Documents Related to Prior Art Under Patent L.R. 3-4(b)

Based on their investigations to date, pursuant to Patent L.R. 3-4(b), Defendants have produced or is producing documents currently within its possession, custody, or control that are the prior art references identified above and/or in the attached charts in connection with Defendants' P.R. 3-3 disclosure, including the prior art Defendants are producing concurrently.

Date: August 23, 2024

Respectfully submitted,

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**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that a true and correct copy of the above and foregoing document has been served on August 23, 2024 to all counsel of record via email.

*Ralph Phillips*

# Appendix A1

**EXHIBIT A-1**

U.S. Patent No. 9,209,485, titled "Electrolytic Copper Foil," to Cheng et al. ("Cheng") (*see* Bates Nos. PRIOR_ART-00000155-PRIOR_ART-00000161), filed on March 18, 2014 and published on January 29, 2015, qualifies as prior art under at least 35 U.S.C. §§ 102 and/or 103 for the asserted claims of U.S. Patent Nos. 10,480,090 ("the '090 patent"), 10,811,689 ("the '689 patent), 11,591,706 (the '706 patent"), and 11,346,014 ("the '014 patent") as discussed in detail in the claim charts below.

The Court has not yet construed the claims and therefore the meaning of the terms in the claims has yet to be resolved by the Court. The support identified herein may be responsive at least in part to Plaintiff's infringement contentions, with which Defendants disagree. As such, nothing in Defendants' claim charts should be construed as an admission regarding infringement, either literally or under the doctrine of equivalents, or as an admission regarding Defendants' understanding of the proper scope of the asserted claims. Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff 's infringement contentions, and/or information obtained during discovery as the case progresses.

To the extent Plaintiff alleges that Cheng does not disclose any particular limitation of the asserted claims of the asserted patents, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the asserted patents to modify Cheng and/or to combine the teachings of Cheng with the knowledge of a person of ordinary skill in the art and/or one or more references identified in Defendants' Invalidity Contentions, including but not limited to the present prior art references cited in the Cover Pleading and the relevant section(s) of claim charts for other prior art references for the asserted patents in a manner that would have rendered the asserted claims invalid as obvious.

Where Defendants cite a particular figure, such citation should be understood to encompass the caption and description of the figure and any text relating to the figure, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Defendants reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Cover Pleading, based on, for example and without limitation, subsequent discovery, any amendments to the pleadings, or rulings from the Court.

**EXHIBIT A-1**

**Invalidity of U.S. Patent No. 10,480,090 in View of Cheng**

| ’090 Patent | Cheng |
|---|---|
| [1pre] An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Cheng discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil for a secondary battery.<br><br>For example:<br><br>“An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first surface; | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a copper layer including a first surface.<br><br>For example:<br><br>“The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62. |

| ’090 Patent | Cheng |
|---|---|
| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second surface opposite to the first surface, | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example:<br><br>“The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62.<br><br>Given that the copper foil is described to have one side and the “other” side, a person of ordinary skill would understand that the claimed copper foil to have a second surface opposite a first surface.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’090 Patent | Cheng |
|---|---|
| [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measures at randomly-selected three points, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940), and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’090 Patent | Cheng |
|---|---|
| [1f] there is at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 1, wherein the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less.<br><br>For example:<br><br>“Roughness Test (the Average Roughness of 10 Points, Rz): The measurement was conducted based on the method of IPC-TM-650 by using a Type Surface Roughness Measuring Instrument (Kosaka Laboratory Ltd; SE1700 series).”<br><br>Cheng at 7:5-8. |

| ’090 Patent | Cheng |
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| | Tables 3 and 4 disclose embodiments with Rz values of 2 μm or less. |

TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

| ’090 Patent | Cheng |
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TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |
| Roughness of S side, Rz (μm) | 1.85 | 1.77 | 1.74 |
| Roughness of M side, Rz (μm) | 1.55 | 1.54 | 1.58 |
| Roughness (Rz) difference between S side and M side (μm) | 0.30 | 0.23 | 0.16 |
| Weight resistivity ($\Omega g/m^2$) | 0.157 | 0.156 | 0.163 |
| TC(111) | 0.84 | 0.71 | 1.04 |
| TC(200) | 0.71 | 0.66 | 1.87 |
| TC(220) | 1.09 | 1.09 | 0.80 |
| TC(311) | 1.36 | 1.54 | 0.29 |
| TC(220) + TC(311)/TC(total) % | 61 | 66 | 27 |
| Crack on copper foil after charging-discharging test | No | No | Yes |

To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples

| ’090 Patent | Cheng |
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| | of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm.<br><br>For example:<br><br>“In the following, embodiments are provided to illustrate the detailed description of the present invention. Those skilled in the art can easily conceive the advantages and effects of the present invention, based on the disclosure of the specification. In the following examples, an electrolytic copper foil with a thickness of 6 or 10 μm was used, but the present invention is not limited by these embodiments.”<br><br>Cheng at 3:44-50.<br><br>“The steps of Embodiment 1 were repeated, except that the thicknesses of the electrolytic copper foils prepared in Embodiments 5 and 6 were 6 μm suitable for use in mobile phones, and the amounts of sulfonic acid-denatured polyvinyl alcohol and glue with a small molecular weight (DV; Nippi Company) added in Embodiments 5 and 6 are shown in Table 1.”<br><br>Cheng at 5:11-18.<br><br>“As shown in Tables 3 and 4, the electrolytic copper foil of the present invention had relatively higher elongation and lower weight resistivity. Further, the electrolytic copper foil of the present application with a thickness of 6 μm satisfied the need of 2000 times of battery charging-discharging tests and had no cracks after the tests. Also, the electrolytic copper foil of the present application with a thickness of 10 μm satisfied the need of 6000 times of battery charging-discharging tests and had no cracks after the tests as shown in Table 3.” |

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| | Cheng at 9:62-10:26.<br><br>“The copper foil of claim 1, comprising, a thickness in the range of 6 to 10 microns.”<br><br>Cheng at Claim 11.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4b] and tensile strength of 30 to 60 kgf/mm2. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) tensile strength of 30 to 60 kgf/mm2.<br><br>For example:<br><br>“Tensile Strength: Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measured at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br><br>Cheng at 6:56-63. |

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TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

Cheng at Table 3.

TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |

Cheng at Table 4.

To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have

| ’090 Patent | Cheng |
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| | been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5pre] A current collector for a secondary battery, the current collector comprising: | To the extent the preamble of claim 5 is found to be limiting, Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a current collector for a secondary battery.<br><br>For example:<br><br>“An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract.<br><br>“A lithium ion secondary battery is produced by coiling an anode plate, a separation membrane, and a cathode plate, placing the anode plate, separation membrane and cathode plate into a container, adding an electrolyte and sealing the container, wherein the anode plate is consisting of a anode current collector constructed by a copper foil and an anode active material (such as a carbon-based material) which is coated on the surface of the anode current collector.”<br><br>Cheng at 1:42-49.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

| ’090 Patent | Cheng |
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| | examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5a] the electrolytic copper foil according to claim 1; and | Cheng discloses or renders the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5b] a protective layer disposed on the electrolytic copper foil, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5c] wherein the protective layer comprises at least one of chromate, benzotriazole, and a silane compound. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’090 Patent** | **Cheng** |
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| [Claim 6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’689 Patent** | **Cheng** |
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| [1pre] An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Cheng discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, which includes a first surface and a second surface opposite the first surface.<br><br>For example:<br><br>“An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract.<br><br>“The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62.<br><br>Given that the copper foil is described to have one side and the “other” side, a person of ordinary skill would understand that the claimed copper foil to have a first surface opposite a second surface. |

| ’689 Patent | Cheng |
|---|---|
| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface; | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a matte surface facing the first surface and a shiny surface facing the second surface.<br><br>For example:<br><br>“An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract.<br><br>“The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62.<br><br>Given that the copper foil is described to have one side and the “other” side, a person of ordinary skill would understand that the claimed copper foil to have a first surface opposite a second surface.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover |

| ’689 Patent | Cheng |
|---|---|
| | Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a first protective layer on the matte surface of the copper layer; and | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a second protective layer on the shiny surface of the copper layer, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

<table>
<tr><th>’689 Patent</th><th>Cheng</th></tr>
<tr><td>copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.),</td><td></td></tr>
<tr><td>[1e] a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2,</td><td>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2,<br><br>For example:<br><br>“Tensile Strength: Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measured at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br><br>Cheng at 6:56-63.<br><br>TABLE 3<br>Test results of the characteristics of electrolytic copper foil<br><table><tr><th></th><th>Embodiment 1</th><th>Embodiment 2</th><th>Embodiment 3</th><th>Embodiment 4</th><th>Comparative Example 1</th><th>Comparative Example 2</th><th>Comparative Example 3</th><th>Comparative Example 4</th><th>Comparative Example 5</th></tr><tr><td>Tensile strength (kg/mm$^2$)</td><td>31.9</td><td>31.6</td><td>31.4</td><td>31.6</td><td>33.4</td><td>32.3</td><td>31.3</td><td>31.1</td><td>38.6</td></tr><tr><td>Elongation (%)</td><td>15.4</td><td>14.2</td><td>15.1</td><td>15.6</td><td>9.5</td><td>9.8</td><td>10.1</td><td>8.2</td><td>10.6</td></tr><tr><td>Roughness of S side, Rz (μm)</td><td>1.73</td><td>1.86</td><td>1.75</td><td>1.68</td><td>1.72</td><td>1.76</td><td>1.72</td><td>1.70</td><td>1.76</td></tr><tr><td>Roughness of M side, Rz (μm)</td><td>1.56</td><td>1.50</td><td>1.49</td><td>1.54</td><td>1.56</td><td>1.62</td><td>1.58</td><td>1.49</td><td>2.42</td></tr></table><br>Cheng at Table 3.</td></tr>
</table>

| ’689 Patent | Cheng |
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TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |

Cheng at Table 4.

A person of ordinary skill would understand that when a copper foil is heated, its tensile strength would decrease slightly. *See, e.g.*, Bennet at 12. (“ The large rise in temperature explains why the tensile strength at the higher current densities was always low. The heat developed by the resistance of the solution keeps the temperature up, and anneals the deposit while forming. Under these conditions the maximum tensile strength is that of soft drawn copper, 30,000 to 35,000 pounds per square inch (21 to 24.5 kg. per sq. mm.).” It would thus be obvious to a person of ordinary skill that the disclosed tensile strength values at room temperature would likely decrease slightly to fall within the claimed range of 21 to 36 kgf/mm2.

To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.

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| | |
| [1f] a weight deviation of the electrolytic copper foil is 5% or less, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1g] a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92, and | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1h] each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less. | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) that each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less.<br><br>For example:<br><br>“Roughness Test (the Average Roughness of 10 Points, Rz): The measurement was conducted based on the method of IPC-TM-650 by using a Type Surface Roughness Measuring Instrument (Kosaka Laboratory Ltd; SE1700 series).”<br><br>Cheng at 7:5-8.<br><br>Tables 3 and 4 disclose embodiments with Rz values of 3.5 μm or less. |

| ’689 Patent | Cheng |
|---|---|

TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

| ’689 Patent | Cheng |
|---|---|

TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |
| Roughness of S side, Rz (μm) | 1.85 | 1.77 | 1.74 |
| Roughness of M side, Rz (μm) | 1.55 | 1.54 | 1.58 |
| Roughness (Rz) difference between S side and M side (μm) | 0.30 | 0.23 | 0.16 |
| Weight resistivity ($\Omega g/m^2$) | 0.157 | 0.156 | 0.163 |
| TC(111) | 0.84 | 0.71 | 1.04 |
| TC(200) | 0.71 | 0.66 | 1.87 |
| TC(220) | 1.09 | 1.09 | 0.80 |
| TC(311) | 1.36 | 1.54 | 0.29 |
| TC(220) + TC(311)/TC(total) % | 61 | 66 | 27 |
| Crack on copper foil after charging-discharging test | No | No | Yes |

To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples

<table>
<tr><th>’689 Patent</th><th>Cheng</th></tr>
<tr><td></td><td>of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.</td></tr>
<tr><td>[Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature.</td><td>Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) an elongation of 3% or more at room temperature.<br><br>For example:<br><br>“Elongation: Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measure at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br><br>TABLE 3<br><br>Test results of the characteristics of electrolytic copper foil<br><br><table><tr><th></th><th>Embodiment 1</th><th>Embodiment 2</th><th>Embodiment 3</th><th>Embodiment 4</th><th>Comparative Example 1</th><th>Comparative Example 2</th><th>Comparative Example 3</th><th>Comparative Example 4</th><th>Comparative Example 5</th></tr><tr><td>Tensile strength ($kg/mm^2$)</td><td>31.9</td><td>31.6</td><td>31.4</td><td>31.6</td><td>33.4</td><td>32.3</td><td>31.3</td><td>31.1</td><td>38.6</td></tr><tr><td>Elongation (%)</td><td>15.4</td><td>14.2</td><td>15.1</td><td>15.6</td><td>9.5</td><td>9.8</td><td>10.1</td><td>8.2</td><td>10.6</td></tr><tr><td>Roughness of S side, Rz (μm)</td><td>1.73</td><td>1.86</td><td>1.75</td><td>1.68</td><td>1.72</td><td>1.76</td><td>1.72</td><td>1.70</td><td>1.76</td></tr><tr><td>Roughness of M side, Rz (μm)</td><td>1.56</td><td>1.50</td><td>1.49</td><td>1.54</td><td>1.56</td><td>1.62</td><td>1.58</td><td>1.49</td><td>2.42</td></tr></table><br><br>Cheng at Table 3.</td></tr>
</table>

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|---|---|
| | TABLE 4<br>Test results of the characteristics of electrolytic copper foil<br><br>Embodiment 5 / Embodiment 6 / Comparative Example 6<br>Tensile strength ($kg/mm^2$): 33.7 / 33.5 / 34.5<br>Elongation (%): 9.4 / 9.7 / 6.2<br><br>Cheng at Table 4.<br><br>To the extent the limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.<br><br>For example:<br><br>“In the following, embodiments are provided to illustrate the detailed description of the present invention. Those skilled in the art can easily conceive the advantages and effects of the present invention, based on the disclosure of the specification. In the following examples, an electrolytic copper foil with a thickness of 6 or 10 μm was used, but the present invention is not limited by these embodiments.”<br><br>Cheng at 3:44-50.<br><br>“The steps of Embodiment 1 were repeated, except that the thicknesses of the electrolytic copper foils prepared in Embodiments 5 and 6 were 6 μm suitable for use in mobile phones, and the amounts of sulfonic acid-denatured polyvinyl alcohol and glue with a small molecular weight (DV; Nippi Company) added in Embodiments 5 and 6 are shown in Table 1.”<br><br>Cheng at 5:11-18.<br><br>“As shown in Tables 3 and 4, the electrolytic copper foil of the present invention had relatively higher elongation and lower weight resistivity. Further, the electrolytic copper foil of the present application with a thickness of 6 μm satisfied the need of 2000 times of battery charging-discharging tests and had no cracks after the tests. Also, the electrolytic copper foil of the present application with a thickness of 10 μm satisfied the need of 6000 times of battery charging-discharging tests and had no cracks after the tests as shown in Table 3.”<br><br>Cheng at 9:62-10:26.<br><br>“The copper foil of claim 1, comprising, a thickness in the range of 6 to 10 microns.” |

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| | Cheng at Claim 11.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion of 17.3 to 22 μm/(m-º C.). | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’706 Patent | Cheng |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, wherein: | To the extent the preamble of claim 1 is found to be limiting, Cheng discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example: |

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| | “An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract.<br><br>“The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) | Cheng discloses (at least based on SKN’s apparent interpretation of the claims) a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br><br>The specification 4:1-2 describes considered planes are (111), (200), (220), (311)]<br>[Specification 3-4 describes use of JCPDS standards for standard copper power. Also describes “the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees”<br><br>Cheng provides the planes that are (111), (200), (220), (311).<br><br>For example: |

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| | “The crystalline phase structure of the electrolytic copper foil of Embodiment 1 was measured with X-ray diffraction to calculate the texture coefficient and the results are recorded in Table 3.”<br><br>Cheng at<br><br>“The crystalline phase structure of the electrolytic copper foil obtained from Embodiment 1 was measured by using X-ray diffraction to calculate the texture coefficient thereof. The methods used in Testing Example are described as below in details.”<br><br>Cheng at<br><br>“An analysis was conducted by using PW3040 X-ray Diffractometer of PANalytical Corporation under conditions of the additional voltage of 45 kV, the current of 40 mA, scanning resolution of 0.04°, and scanning range (2θ) of 40°-95°. The texture coefficient of each test sample is calculated based on the following Equation (I).”<br><br>$$TC(hkl) = \frac{I(hkl)/I_0(hkl)}{(1/n)\Sigma I(hkl)/I_0(hkl)}$$ Equation (I)<br><br>In Equation (I), TC(hkl) is the texture coefficient of (hkl) crystalline surface. When TC value is greater, it means that the crystalline surface preferred orientation degree is higher. I(hkl) refers to the diffraction strength of the (hkl) crystalline surface of the test sample. Io(hkl) refers to the diffraction strength (PDF#040836) of the (hkl) crystalline surface of standard copper powder defined by American Society of Testing Materials (ASTM). N refers to the quantity of the diffraction peaks within a specific range of diffraction angles (2θ).”<br><br>Cheng at 7:17-36. |

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| | Cheng discloses six embodiments with a texture coefficients of a (220) plane within the claimed range of 0.49 to 1.28: |

TABLE 3-continued

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Roughness (Rz) difference between S side and M side (μm) | 0.17 | 0.36 | 0.26 | 0.14 | 0.16 | 0.14 | 0.14 | 0.21 | 0.66 |
| Weight resistivity ($\Omega g/m^2$) | 0.154 | 0.156 | 0.154 | 0.155 | 0.163 | 0.162 | 0.160 | 0.161 | 0.155 |
| TC (111) | 0.23 | 0.62 | 0.33 | 0.32 | 1.03 | 0.98 | 0.91 | 1.01 | 0.30 |
| TC (200) | 0.23 | 0.58 | 0.30 | 0.33 | 1.85 | 1.51 | 1.66 | 1.63 | 0.18 |
| TC (220) | 1.04 | 1.08 | 1.07 | 1.06 | 0.82 | 0.72 | 0.77 | 0.70 | 3.20 |
| TC (311) | 2.50 | 1.72 | 2.30 | 2.29 | 0.30 | 0.79 | 0.66 | 0.66 | 0.32 |
| TC (220) + TC (311)/ TC (total)% | 89 | 70 | 84 | 84 | 28 | 38 | 36 | 34 | 88 |
| Crack on copper foil after charging-discharging test | No | No | No | No | Yes | Yes | Yes | Yes | Yes |

Cheng at Table 3.

To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples

| ’706 Patent | Cheng |
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| | of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a difference (\|Δ(Rz/Ra)\|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples |

| ’706 Patent | Cheng |
|---|---|
| second surface is 4.2 to 9.0. | of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2.<br><br>For example:<br><br>“Tensile Strength: Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measured at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br><br>Cheng at 6:56-63. |

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TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

Cheng at Table 3.

TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |

Cheng at Table 4.

To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of

| ’706 Patent | Cheng |
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| | the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 5] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation measured at room temperature, of 3% or more.<br><br>For example:<br><br>“Elongation: Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measure at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br><br>Cheng at 6:64-7:4. |

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TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

Cheng at Table 3.

TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |

Cheng at Table 4.

To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of

| ’706 Patent | Cheng |
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| | the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Cheng |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Cheng discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>“An electrolytic copper foil, which is particularly suitable for the application of a lithium ion secondary battery, has a shiny side and a matte side with a roughness of less than 2 μm.”<br><br>Cheng at Abstract. |

| ’014 Patent | Cheng |
|---|---|
| | “The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other side is called ‘matte side (M side).’”<br><br>Cheng at 1:59-62.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first protective layer at the first surface; | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second protective layer at the second surface; and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Cheng |
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| [1c] a copper film disposed between the first and second protective layers, wherein | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer). | |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) |

| ’014 Patent | Cheng |
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| coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes, | wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes.<br><br>For example:<br><br>“The crystalline phase structure of the electrolytic copper foil of Embodiment 1 was measured with X-ray diffraction to calculate the texture coefficient and the results are recorded in Table 3.”<br><br>Cheng at<br><br>“The crystalline phase structure of the electrolytic copper foil obtained from Embodiment 1 was measured by using X-ray diffraction to calculate the texture coefficient thereof. The methods used in Testing Example are described as below in details.”<br><br>Cheng at<br><br>“An analysis was conducted by using PW3040 X-ray Diffractometer of PANalytical Corporation under conditions of the additional voltage of 45 kV, the current of 40 mA, scanning resolution of 0.04°, and scanning range (2θ) of 40°-95°. The texture coefficient of each test sample is calculated based on the following Equation (I).”<br><br>$$TC(hkl) = \frac{I(hkl)/I_0(hkl)}{(1/n)\Sigma I(hkl)/I_0(hkl)}$$ Equation (I) |

| '014 Patent | Cheng |
|---|---|
| | In Equation (I), TC(hkl) is the texture coefficient of (hkl) crystalline surface. When TC value is greater, it means that the crystalline surface preferred orientation degree is higher. I(hkl) refers to the diffraction strength of the (hkl) crystalline surface of the test sample. Io(hkl) refers to the diffraction strength (PDF#040836) of the (hkl) crystalline surface of standard copper powder defined by American Society of Testing Materials (ASTM). N refers to the quantity of the diffraction peaks within a specific range of diffraction angles (2θ)."<br><br>Cheng at 7:17-36.<br><br>Cheng discloses six embodiments with a texture coefficients of a (220) plane within the claimed range of 0.49 to 1.28:<br><br>TABLE 3-continued<br>Test results of the characteristics of electrolytic copper foil<br><br>Roughness (Rz) difference between S side and M side (μm): Embodiment 1: 0.17; Embodiment 2: 0.36; Embodiment 3: 0.26; Embodiment 4: 0.14; Comparative Example 1: 0.16; Comparative Example 2: 0.14; Comparative Example 3: 0.14; Comparative Example 4: 0.21; Comparative Example 5: 0.66<br>Weight resistivity ($\Omega g/m^2$): 0.154; 0.156; 0.154; 0.155; 0.163; 0.162; 0.160; 0.161; 0.155<br>TC (111): 0.23; 0.62; 0.33; 0.32; 1.03; 0.98; 0.91; 1.01; 0.30<br>TC (200): 0.23; 0.58; 0.30; 0.33; 1.85; 1.51; 1.66; 1.63; 0.18<br>TC (220): 1.04; 1.08; 1.07; 1.06; 0.82; 0.72; 0.77; 0.70; 3.20<br>TC (311): 2.50; 1.72; 2.30; 2.29; 0.30; 0.79; 0.66; 0.66; 0.32<br>TC (220) + TC (311)/ TC (total)%: 89; 70; 84; 84; 28; 38; 36; 34; 88<br>Crack on copper foil after charging-discharging test: No; No; No; No; Yes; Yes; Yes; Yes; Yes<br><br>Cheng at Table 3. |

| ’014 Patent | Cheng |
|---|---|
| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Cheng, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. | Cheng discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Cheng discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature.<br><br>“Tensile Strength:<br>Based on the method of IPC-TM-650, the electrolytic copper foil was cut to obtain a test sample with the size of 100 mm×12.7 mm (length×width), and the test sample was measured at room temperature (around 25° C.) under the conditions of a chuck distance of 50 mm and a crosshead speed of 50 mm/min by using Model AG-1 testing machine of Shimadzu Corporation.”<br>*Cheng* at 6:55-65. |

| ’014 Patent | Cheng |
|---|---|

TABLE 3

Test results of the characteristics of electrolytic copper foil

| | Embodiment 1 | Embodiment 2 | Embodiment 3 | Embodiment 4 | Comparative Example 1 | Comparative Example 2 | Comparative Example 3 | Comparative Example 4 | Comparative Example 5 |
|---|---|---|---|---|---|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 31.9 | 31.6 | 31.4 | 31.6 | 33.4 | 32.3 | 31.3 | 31.1 | 38.6 |
| Elongation (%) | 15.4 | 14.2 | 15.1 | 15.6 | 9.5 | 9.8 | 10.1 | 8.2 | 10.6 |
| Roughness of S side, Rz (μm) | 1.73 | 1.86 | 1.75 | 1.68 | 1.72 | 1.76 | 1.72 | 1.70 | 1.76 |
| Roughness of M side, Rz (μm) | 1.56 | 1.50 | 1.49 | 1.54 | 1.56 | 1.62 | 1.58 | 1.49 | 2.42 |

*Id*. at TABLE 3.

| ’014 Patent | Cheng |
|---|---|

TABLE 4

Test results of the characteristics of electrolytic copper foil

| | Embodiment 5 | Embodiment 6 | Comparative Example 6 |
|---|---|---|---|
| Tensile strength ($kg/mm^2$) | 33.7 | 33.5 | 34.5 |
| Elongation (%) | 9.4 | 9.7 | 6.2 |
| Roughness of S side, Rz (μm) | 1.85 | 1.77 | 1.74 |
| Roughness of M side, Rz (μm) | 1.55 | 1.54 | 1.58 |
| Roughness (Rz) difference between S side and M side (μm) | 0.30 | 0.23 | 0.16 |
| Weight resistivity ($\Omega g/m^2$) | 0.157 | 0.156 | 0.163 |
| TC(111) | 0.84 | 0.71 | 1.04 |
| TC(200) | 0.71 | 0.66 | 1.87 |
| TC(220) | 1.09 | 1.09 | 0.80 |
| TC(311) | 1.36 | 1.54 | 0.29 |
| TC(220) + TC(311)/TC(total) % | 61 | 66 | 27 |
| Crack on copper foil after charging-discharging test | No | No | Yes |

*Id*. at TABLE 4.

To the extent that this limitation is not disclosed, either explicitly or inherently, by *Suzuki, Ch. 10*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of

| ’014 Patent | Cheng |
|---|---|
| | the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

# Appendix A3

**EXHIBIT A-3**

U.S. Patent No. 8,715,836, titled "Surface-Treated Electro-Deposited Copper Foil and Method for Manufacturing the Same," to Dobashi et al. ("Dobashi") (*see* Bates Nos. PRIOR_ART-00000174-PRIOR_ART-00000190), filed on March 9, 2007 and published on February 19, 2009, qualifies as prior art under at least 35 U.S.C. §§ 102 and/or 103 for the asserted claims of U.S. Patent Nos. 9,457,541 ("the '541 patent"), 10,480,090 ("the '090 patent"), 10,811,689 ("the '689 patent), 11,591,706 (the '706 patent"), and 11,346,014 ("the '014 patent") as discussed in detail in the claim charts below.

The Court has not yet construed the claims and therefore the meaning of the terms in the claims has yet to be resolved by the Court. The support identified herein may be responsive at least in part to Plaintiff's infringement contentions, with which Defendants disagree. As such, nothing in Defendants' claim charts should be construed as an admission regarding infringement, either literally or under the doctrine of equivalents, or as an admission regarding Defendants' understanding of the proper scope of the asserted claims. Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff 's infringement contentions, and/or information obtained during discovery as the case progresses.

To the extent Plaintiff alleges that Dobashi does not disclose any particular limitation of the asserted claims of the asserted patents, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the asserted patents to modify Dobashi and/or to combine the teachings of Dobashi with the knowledge of a person of ordinary skill in the art and/or one or more references identified in Defendants' Invalidity Contentions, including but not limited to the present prior art references cited in the Cover Pleading and the relevant section(s) of claim charts for other prior art references for the asserted patents in a manner that would have rendered the asserted claims invalid as obvious.

Where Defendants cite a particular figure, such citation should be understood to encompass the caption and description of the figure and any text relating to the figure, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Defendants reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Cover Pleading, based on, for example and without limitation, subsequent discovery, any amendments to the pleadings, or rulings from the Court.

**EXHIBIT A-3**

**Invalidity of U.S. Patent No. 9,457,541 in View of Dobashi**

| ’541 Patent | Dobashi |
|---|---|
| [1pre] A copper foil for a current collector of a lithium secondary battery, wherein, | To the extent the preamble of claim 1 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a copper foil for a printed circuit board, which can also be used for a lithium secondary battery. See, e.g., Wolski, PRIOR_ART-00002283 at Abstract.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.”<br><br>Dobashi at 22:21-24.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] in a crystalline structure, a ratio of a sum of texture coefficients of a (111) | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in |

| ’541 Patent | Dobashi |
|---|---|
| surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, wherein the texture coefficient satisfies the following equation: TC(hkl)≥$I$(hkl)$I$0(hkl)1$n\Sigma I$(hkl)$I$0(hkl) wherein I(hkl) represents a measured diffraction intensity with respect to a (hkl) surface, and I0(hkl) represents a standard diffraction intensity of ASTM (American Society of Testing Materials) standard powder-shaped diffraction data, | the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] wherein the copper foil has a weight deviation of 3% or less, and | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example: |

| ’541 Patent | Dobashi |
|---|---|
| | Dobashi discloses a desire for the copper foils to be uniform:<br><br>“In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform.”<br><br>Dobashi at 10:22-26.<br><br>“In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform. The upper limit of the gloss [Gs (60°)] of the deposit side is empirically around 800.”<br><br>Dobashi at 10:22-27.<br><br>“Particularly when a thin electro-deposited copper foil is to be manufactured, it is effective to cover the surface of the rotating cathode uniformly with copper as an initial deposit layer formed in a first-step electrolysis process just after starting of copper electrolysis to obtain an electro-deposited copper foil having a deposit side having a low profile and small waviness.”<br><br>Dobashi at 10:47-53.<br><br>“Although there is some level difference in all items, the electro-deposited copper foils have a deposit side excellent in both smoothness and small waviness. Also, no TD/MD direction difference is seen, and the foils are uniform.”<br><br>Dobashi at 20:15-18.<br><br>A person of ordinary skill would understand that a low weight deviation is necessary to achieve uniform copper foils. It would therefore be obvious to a person of ordinary skill |

| ’541 Patent | Dobashi |
|---|---|
| | that the copper foil disclosed in Dobashi should have a low weight deviation as claimed in the ’541 Patent.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi , this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] wherein the copper foil has a tensile strength of 30 to 40 kgf/mm$^2$, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi , this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] so as to prevent the generation of wrinkles at a surface of the copper foil. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’541 Patent** | **Dobashi** |
|---|---|
| | |
| [Claim 2] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less. | Dobashi discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less.<br><br>For example:<br><br>“It is described that the roughness of the deposit side, which is a laminate surface (a bonding surface) to be bonded to an insulating substrate, is small, and that for an electro-deposited copper foil having a thickness of 10 μm, a low profile with a 10-point average roughness Rz of about 1.0 μm±0.5 μm is obtained.”<br><br>Dobashi at 2:11-16.<br><br>“It is also preferable that in the surface-treated electro-deposited copper foil according to the present invention, the surface roughness (Rzjis) of the bonding surface is 0.1 μm to 1.0 μm.”<br><br>Dobashi at 3:25-28.<br><br>“An electro-deposited copper foil according to the present invention is an electro-deposited copper foil used for the manufacturing of the surface-treated electro-deposited copper foil, characterized in that the surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil is 0.4 μm to 2.0 μm.”<br><br>Dobashi at 3:34-40.<br><br>“The surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil according to the present invention is preferably 0.4 μm to 2.0 μm, and more preferably 0.4 |

| ’541 Patent | Dobashi |
|---|---|
| | μm to 1.8 μm. The surface roughness (Rzjis) is a numerical value obtained by measuring in the TD direction according to JIS B 0601-2001 as for the deposit side.”<br><br>Dobashi at 9:13-16.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi , this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi , this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm. | Dobashi discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm.<br><br>For example: |

| ’541 Patent | Dobashi |
|---|---|
| | Dobashi discloses examples having a thickness between 12-15 μm: |

TABLE 2

| | | Deposit side of electro-deposited copper foil | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Copper foil | Three-dimensional surface structure analysis | | | Stylus-type roughness meter | | Gloss Gs | |
| | thickness | Wmax | PV | Wmax/PV | Rzjis | RSm | (60°) | |
| Subject | (μm) | (μm) | (μm) | (-) | (μm) | (mm) | TD | MD |
| Example 1 | 15 | 0.37 | 0.39 | 0.949 | 0.32 | 0.19 | 659 | 665 |
| Example 2 | 12 | 0.45 | 0.48 | 0.938 | 0.31 | 0.16 | 664 | 671 |
| Example 3 | 70 | 0.065 | 0.079 | 0.823 | 0.17 | 0.39 | 691 | 686 |

TABLE 2-continued

| | | Deposit side of electro-deposited copper foil | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Copper foil | Three-dimensional surface structure analysis | | | Stylus-type roughness meter | | Gloss Gs | |
| | thickness | Wmax | PV | Wmax/PV | Rzjis | RSm | (60°) | |
| Subject | (μm) | (μm) | (μm) | (-) | (μm) | (mm) | TD | MD |
| Example 4 | 15 | 0.27 | 0.30 | 0.904 | 0.29 | 0.18 | 790 | 790 |
| Example 5 | 15 | 0.36 | 0.39 | 0.943 | 0.31 | 0.16 | 775 | 773 |
| Example 6 | 12 | 0.42 | 0.44 | 0.959 | 0.47 | 0.22 | 654 | 687 |
| Example 7 | 12 | 0.58 | 0.66 | 0.869 | 0.71 | 0.14 | 608 | 640 |
| Comparative Example | 12 | 0.82 | 1.87 | 0.439 | 1.00 | 0.07 | 324 | 383 |

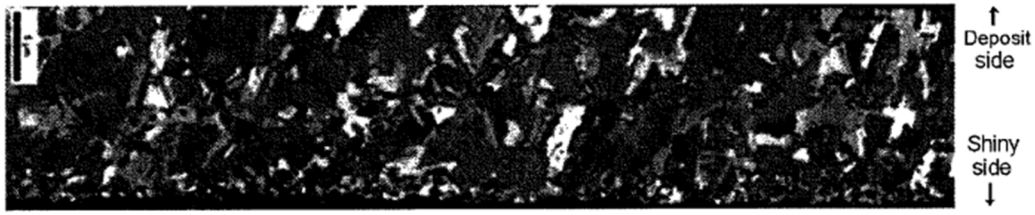
Dobashi at Table 2.

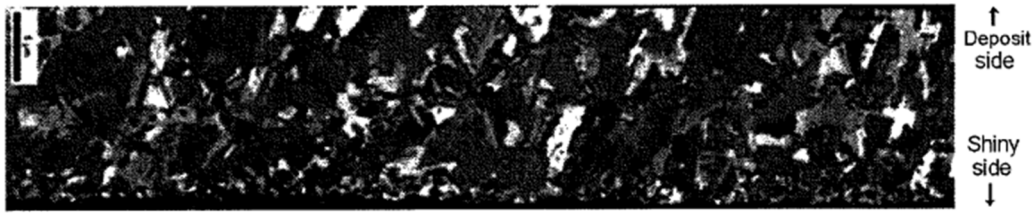
| ’541 Patent | Dobashi |
|---|---|
| | Although Dobashi also discloses an example having a thickness of 70 μm, the samples having a thickness within the claimed range were satisfactory copper foils.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi , this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

**Invalidity of U.S. Patent No. 10,480,090 in View of Dobashi**

| ’090 Patent | Dobashi |
|---|---|
| [1pre] An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil for a secondary battery.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.” |

| ’090 Patent | Dobashi |
|---|---|
| | Dobashi at 22:21-24.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first surface; | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a copper layer including a first surface.<br><br>For example:<br><br>“To achieve such objects, Patent Document 1 discloses a surface-treated electro-deposited copper foil characterized in that roughening treatment on a bonding surface is provided on the deposit side of a foil, in which the surface roughness Rz of the deposit side of a drum foil is equal to or smaller than the surface roughness Rz of the shiny side of the drum foil.”<br><br>Dobashi at 1:56-61. |

| ’090 Patent | Dobashi |
|---|---|
| | Fig 4<br>  <br><br><br>Dobashi at Fig. 4.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second surface opposite to the first surface, | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example:<br>“To achieve such objects, Patent Document 1 discloses a surface-treated electro-deposited copper foil characterized in that roughening treatment on a bonding surface is provided on the deposit side of a foil, in which the surface roughness Rz of the deposit side of a drum foil is equal to or smaller than the surface roughness Rz of the shiny side of the drum foil.”<br><br>Dobashi at 1:56-61. |

| ’090 Patent | Dobashi |
|---|---|
| | Fig 4<br>  <br><br>Dobashi at Fig. 4.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'090 Patent** | **Dobashi** |
|---|---|
| [1d] wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measures at randomly-selected three points, | Dobashi discloses (at least based on SKN's apparent interpretation of the claims) that the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measures at randomly-selected three points.<br><br>For example:<br><br>Dobashi discloses RSm measurements, as defined in the JIS B 0601 (2001) standards:<br><br>"Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small."<br><br>Dobashi at 6:13-29.<br><br>A person of ordinary skill would understand that RPc measures peak count roughness. A person of ordinary skill would also understand, based on the JIS B 0601 standard, that the RSm measurement in Dobashi is equivalent to a measure of the spacing between peaks. A person of ordinary skill would thus understand that RSm and Rpc both measure the number of peaks per area of a sample.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] the peak count roughness Rpc of each point is the number of effective peaks | Dobashi discloses (at least based on SKN's apparent interpretation of the claims) that the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper |

| **'090 Patent** | **Dobashi** |
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| with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940), and | criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940).<br><br>For example:<br><br>Dobashi discloses RSm measurements, as defined in the JIS B 0601 (2001) standards:<br><br>"Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small."<br><br>Dobashi at 6:13-29.<br><br>A person of ordinary skill would understand that RPc measures peak count roughness. A person of ordinary skill would also understand, based on the JIS B 0601 standard, that the RSm measurement in Dobashi is equivalent to a measure of the spacing between peaks. A person of ordinary skill would thus understand that RSm and Rpc both measure the number of peaks per area of a sample.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] there is at least one valley deeper than a lower criteria line of -0.5 μm between | Dobashi discloses (at least based on SKN's apparent interpretation of the claims) that there is at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. |

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| adjacent ones of the effective peaks. | For example:<br><br>Dobashi discloses RSm measurements, as defined in the JIS B 0601 (2001) standards:<br><br>“Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small.”<br><br>Dobashi at 6:13-29.<br><br>A person of ordinary skill would understand that RPc measures peak count roughness. A person of ordinary skill would also understand, based on the JIS B 0601 standard, that the RSm measurement in Dobashi is equivalent to a measure of the spacing between peaks. A person of ordinary skill would thus understand that RSm and Rpc both measure the number of peaks per area of a sample.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil wherein a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. |

| **'090 Patent** | **Dobashi** |
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| | For example:<br><br>Dobashi discloses RSm measurements, as defined in the JIS B 0601 (2001) standards:<br><br>"Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small."<br><br>Dobashi at 6:13-29.<br><br>A person of ordinary skill would understand that RPc measures peak count roughness. A person of ordinary skill would also understand, based on the JIS B 0601 standard, that the RSm measurement in Dobashi is equivalent to a measure of the spacing between peaks. A person of ordinary skill would thus understand that RSm and Rpc both measure the number of peaks per area of a sample.<br><br>Further, a person of ordinary skill would understand that it is desirable for both surfaces of the copper foil to have similar surface roughness profiles in order to avoid degradation of the charge/discharge cycle. It therefore would have been obvious that the different in RPc between the two surfaces should be less than 60.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1. |

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| 1, wherein the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. | Dobashi discloses (at least based on SKN's apparent interpretation of the claims) the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less.<br><br>For example:<br><br>"It is described that the roughness of the deposit side, which is a laminate surface (a bonding surface) to be bonded to an insulating substrate, is small, and that for an electro-deposited copper foil having a thickness of 10 μm, a low profile with a 10-point average roughness Rz of about 1.0 μm±0.5 μm is obtained."<br><br>Dobashi at 2:11-16.<br><br>"It is also preferable that in the surface-treated electro-deposited copper foil according to the present invention, the surface roughness (Rzjis) of the bonding surface is 0.1 μm to 1.0 μm."<br><br>Dobashi at 3:25-28.<br><br>"An electro-deposited copper foil according to the present invention is an electro-deposited copper foil used for the manufacturing of the surface-treated electro-deposited copper foil, characterized in that the surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil is 0.4 μm to 2.0 μm."<br><br>Dobashi at 3:34-40.<br><br>"The surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil according to the present invention is preferably 0.4 μm to 2.0 μm, and more preferably 0.4 μm to 1.8 μm. The surface roughness (Rzjis) is a numerical value obtained by measuring in the TD direction according to JIS B 0601-2001 as for the deposit side."<br><br>Dobashi at 9:13-16. |

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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm.<br><br>For example:<br><br>Dobashi discloses examples having a thickness between 12-15 μm: |

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TABLE 2

| | | Deposit side of electro-deposited copper foil | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Copper foil | Three-dimensional surface structure analysis | | | Stylus-type roughness meter | | Gloss Gs | |
| | thickness | Wmax | PV | Wmax/PV | Rzjis | RSm | (60°) | |
| Subject | (μm) | (μm) | (μm) | (-) | (μm) | (mm) | TD | MD |
| Example 1 | 15 | 0.37 | 0.39 | 0.949 | 0.32 | 0.19 | 659 | 665 |
| Example 2 | 12 | 0.45 | 0.48 | 0.938 | 0.31 | 0.16 | 664 | 671 |
| Example 3 | 70 | 0.065 | 0.079 | 0.823 | 0.17 | 0.39 | 691 | 686 |

TABLE 2-continued

| | | Deposit side of electro-deposited copper foil | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Copper foil | Three-dimensional surface structure analysis | | | Stylus-type roughness meter | | Gloss Gs | |
| | thickness | Wmax | PV | Wmax/PV | Rzjis | RSm | (60°) | |
| Subject | (μm) | (μm) | (μm) | (-) | (μm) | (mm) | TD | MD |
| Example 4 | 15 | 0.27 | 0.30 | 0.904 | 0.29 | 0.18 | 790 | 790 |
| Example 5 | 15 | 0.36 | 0.39 | 0.943 | 0.31 | 0.16 | 775 | 773 |
| Example 6 | 12 | 0.42 | 0.44 | 0.959 | 0.47 | 0.22 | 654 | 687 |
| Example 7 | 12 | 0.58 | 0.66 | 0.869 | 0.71 | 0.14 | 608 | 640 |
| Comparative Example | 12 | 0.82 | 1.87 | 0.439 | 1.00 | 0.07 | 324 | 383 |

Although Dobashi also discloses an example having a thickness of 70 μm, the samples having a thickness within the claimed range were satisfactory copper foils.

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| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4b] and tensile strength of 30 to 60 kgf/mm2. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5pre] A current collector for a secondary battery, the current collector comprising: | To the extent the preamble of claim 5 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a current collector for a secondary battery.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.” |

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| | Dobashi at 22:21-24.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5a] the electrolytic copper foil according to claim 1; and | Dobashi discloses or renders the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5b] a protective layer disposed on the electrolytic copper foil, | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a protective layer disposed on the electrolytic copper foil.<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in |

| ’090 Patent | Dobashi |
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| | that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>Dobashi at 3:8-17.<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are |

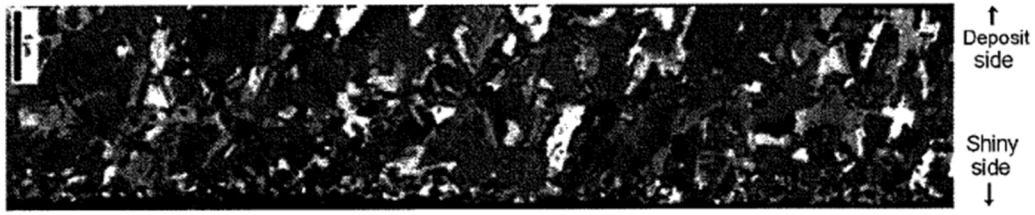
| ’090 Patent | Dobashi |
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| | discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5c] wherein the protective layer comprises at least one of chromate, benzotriazole, and a silane compound. | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) that the protective layer comprises at least one of chromate, benzotriazole, and a silane compound.<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid |

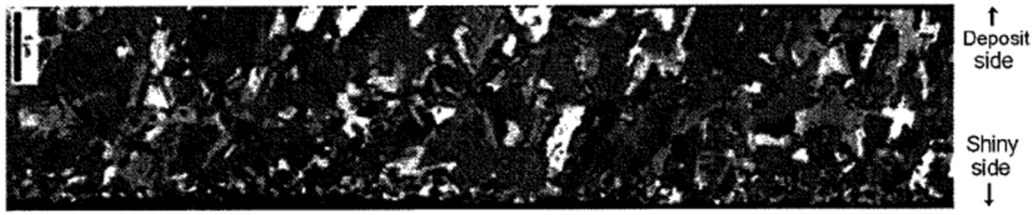
| ’090 Patent | Dobashi |
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| | concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil. | Dobashi discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 5.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil.<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro- |

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| | deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable |

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| | solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1pre] An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, which includes a first surface and a second surface opposite the first surface.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.”<br><br>Dobashi at 22:21-24.<br><br>Dobashi discloses a copper foil having two surfaces:<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11.”<br><br>Dobashi at 17:43-44.<br><br>“To achieve such objects, Patent Document 1 discloses a surface-treated electro-deposited copper foil characterized in that roughening treatment on a bonding surface is provided on the deposit side of a foil, |

| ’689 Patent | Dobashi |
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| | in which the surface roughness Rz of the deposit side of a drum foil is equal to or smaller than the surface roughness Rz of the shiny side of the drum foil.”<br><br>Dobashi at 1:56-61.<br><br>Fig 4<br>  <br><br>Dobashi at Fig. 4.<br><br>A person of ordinary skill would understand that the two surfaces of a single copper foil would be opposite one another.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a copper layer including a matte surface facing the first | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a matte surface facing the first surface and a shiny surface facing the second surface. |

| ’689 Patent | Dobashi |
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| surface and a shiny surface facing the second surface; | For example:<br><br>“To achieve such objects, Patent Document 1 discloses a surface-treated electro-deposited copper foil characterized in that roughening treatment on a bonding surface is provided on the deposit side of a foil, in which the surface roughness Rz of the deposit side of a drum foil is equal to or smaller than the surface roughness Rz of the shiny side of the drum foil.”<br><br>Dobashi at 1:56-61.<br><br>Fig 4<br>  <br><br><br>Dobashi at Fig. 4.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a first protective layer on the matte | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer on the matte surface of the copper layer. |

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| surface of the copper layer; and | For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54. |

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| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a second protective layer on the shiny surface of the copper layer, | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer on the shiny surface of the copper layer.<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15. |

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| | “Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| 5º C./min, ranges from 16 to 22 μm/(m-º C.), | |
| [1e] a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2, | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] a weight deviation of the electrolytic copper foil is 5% or less, | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a weight deviation of the electrolytic copper foil is 5% or less.<br><br>For example:<br><br>Dobashi discloses a desire for the copper foils to be uniform:<br><br>“In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform.”<br><br>Dobashi at 10:22-26.<br><br>“In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform. The upper limit of the gloss [Gs (60°)] of the deposit side is empirically around 800.”<br><br>Dobashi at 10:22-27.<br><br>“Particularly when a thin electro-deposited copper foil is to be manufactured, it is effective to cover the surface of the rotating cathode uniformly with copper as an initial deposit layer formed in a first-step |

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| | electrolysis process just after starting of copper electrolysis to obtain an electro-deposited copper foil having a deposit side having a low profile and small waviness.”<br><br>Dobashi at 10:47-53.<br><br>“Although there is some level difference in all items, the electro-deposited copper foils have a deposit side excellent in both smoothness and small waviness. Also, no TD/MD direction difference is seen, and the foils are uniform.”<br><br>Dobashi at 20:15-18.<br><br>A person of ordinary skill would understand that a low weight deviation is necessary to achieve uniform copper foils. It would therefore be obvious to a person of ordinary skill that the copper foil disclosed in Dobashi should have a low weight deviation as claimed in the ’689 Patent.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1g] a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1h] each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less. | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) that each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less.<br><br>For example:<br><br>“It is described that the roughness of the deposit side, which is a laminate surface (a bonding surface) to be bonded to an insulating substrate, is small, and that for an electro-deposited copper foil having a thickness of 10 μm, a low profile with a 10-point average roughness Rz of about 1.0 μm±0.5 μm is obtained.”<br><br>Dobashi at 2:11-16.<br><br>“It is also preferable that in the surface-treated electro-deposited copper foil according to the present invention, the surface roughness (Rzjis) of the bonding surface is 0.1 μm to 1.0 μm.”<br><br>Dobashi at 3:25-28.<br><br>“An electro-deposited copper foil according to the present invention is an electro-deposited copper foil used for the manufacturing of the surface-treated electro-deposited copper foil, characterized in that the surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil is 0.4 μm to 2.0 μm.”<br><br>Dobashi at 3:34-40.<br><br>“The surface roughness (Rzjis) of the shiny side of the electro-deposited copper foil according to the present invention is preferably 0.4 μm to 2.0 μm, and more preferably 0.4 μm to 1.8 μm. The surface roughness (Rzjis) is a numerical value obtained by measuring in the TD direction according to JIS B 0601-2001 as for the deposit side.”<br><br>Dobashi at 9:13-16.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have |

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| | been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature. | To the extent the limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound.<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent |

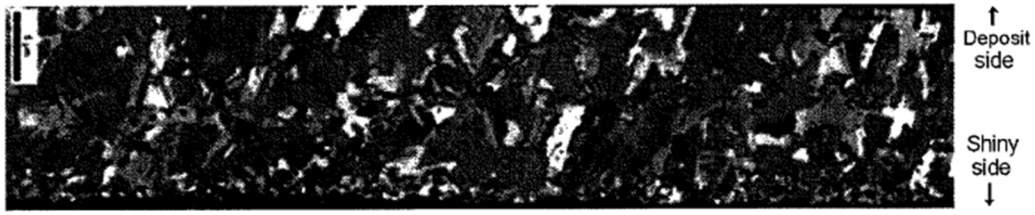
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| | from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm. | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1. |

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| | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.<br><br>For example:<br><br>Dobashi discloses examples having a thickness between 12-15 μm:<br><br>TABLE 2<br><br>Deposit side of electro-deposited copper foil<br><br>Three-dimensional surface structure analysis<br><br>Stylus-type roughness meter<br><br>Gloss Gs (60°)<br><br>Subject / Copper foil thickness (μm) / Wmax (μm) / PV (μm) / Wmax/PV (-) / Rzjis (μm) / RSm (mm) / TD / MD<br><br>Example 1: 15 / 0.37 / 0.39 / 0.949 / 0.32 / 0.19 / 659 / 665<br>Example 2: 12 / 0.45 / 0.48 / 0.938 / 0.31 / 0.16 / 664 / 671<br>Example 3: 70 / 0.065 / 0.079 / 0.823 / 0.17 / 0.39 / 691 / 686 |

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| | TABLE 2-continued<br><br>Deposit side of electro-deposited copper foil<br><br>Three-dimensional surface structure analysis; Stylus-type roughness meter; Gloss Gs (60°)<br><br>Subject / Copper foil thickness (μm) / Wmax (μm) / PV (μm) / Wmax/PV (-) / Rzjis (μm) / RSm (mm) / Gloss Gs (60°) TD / Gloss Gs (60°) MD<br><br>Example 4: 15 / 0.27 / 0.30 / 0.904 / 0.29 / 0.18 / 790 / 790<br>Example 5: 15 / 0.36 / 0.39 / 0.943 / 0.31 / 0.16 / 775 / 773<br>Example 6: 12 / 0.42 / 0.44 / 0.959 / 0.47 / 0.22 / 654 / 687<br>Example 7: 12 / 0.58 / 0.66 / 0.869 / 0.71 / 0.14 / 608 / 640<br>Comparative Example: 12 / 0.82 / 1.87 / 0.439 / 1.00 / 0.07 / 324 / 383<br><br>Although Dobashi also discloses an example having a thickness of 70 μm, the samples having a thickness within the claimed range were satisfactory copper foils.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5] The electrolytic copper foil of claim 1, having a coefficient of | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference |

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| thermal expansion of 17.3 to 22 μm/(m-º C.). | with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1pre] An electrolytic copper foil having a first surface and a second surface, wherein: | To the extent the preamble of claim 1 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.”<br><br>Dobashi at 22:21-24.<br><br>Dobashi discloses a copper foil having two surfaces:<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11.”<br><br>Dobashi at 17:43-44. |

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| | “To achieve such objects, Patent Document 1 discloses a surface-treated electro-deposited copper foil characterized in that roughening treatment on a bonding surface is provided on the deposit side of a foil, in which the surface roughness Rz of the deposit side of a drum foil is equal to or smaller than the surface roughness Rz of the shiny side of the drum foil.”<br><br>Dobashi at 1:56-61.<br><br>Fig 4<br>  <br><br><br>Dobashi at Fig. 4.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a texture coefficient of (220) plane of the electrolytic | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of |

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| copper foil defined by Equation 1 below is 0.4 to 1.32, TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) | the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a difference (\|Δ(Rz/Ra)\|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less. | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less.<br><br>For example:<br><br>Dobashi discloses RSm measurements, as defined in the JIS B 0601 (2001) standards:<br><br>“Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small.” |

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| | Dobashi at 6:13-29.<br><br>A person of ordinary skill would understand that RSm and PD are closely linked, because RSm is a measure of spacing between peaks and provides a measurement of the number of peaks per unit length. A person of ordinary skill would understand that PD is a value that is inverse to RSm, and can be calculated using the disclosed RSm and PV (to determine the upper limits) values. A person of ordinary skill would thus know that once calculated, the PD values disclosed in Dobashi fall within the claimed range.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

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| surface of the electrolytic copper foil is 5.1 to 6.8. | examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 5] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less. | Dobashi discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less.<br><br>For example:<br><br>Dobashi discloses a desire for uniformity: |

| ’706 Patent | Dobashi |
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| | “In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform.”<br><br>Dobashi at 10:22-26.<br><br>“In order to obtain a surface-treated electro-deposited copper foil having a good surface condition, the surface of the deposit side of the electro-deposited copper foil as a base is required to be smooth and uniform. The upper limit of the gloss [Gs (60°)] of the deposit side is empirically around 800.”<br><br>Dobashi at 10:22-27.<br><br>“Particularly when a thin electro-deposited copper foil is to be manufactured, it is effective to cover the surface of the rotating cathode uniformly with copper as an initial deposit layer formed in a first-step electrolysis process just after starting of copper electrolysis to obtain an electro-deposited copper foil having a deposit side having a low profile and small waviness.”<br><br>Dobashi at 10:47-53.<br><br>“Although there is some level difference in all items, the electro-deposited copper foils have a deposit side excellent in both smoothness and small waviness. Also, no TD/MD direction difference is seen, and the foils are uniform.”<br><br>Dobashi at 20:15-18.<br><br>A person of ordinary skill would understand that a low weight deviation is necessary to achieve uniform copper foils. It would therefore be obvious to a person of ordinary skill that the copper foil disclosed in Dobashi should have a low weight deviation as claimed in the ’706 Patent<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference |

| ’706 Patent | Dobashi |
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| | with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Dobashi |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>“a surface-treated electro-deposited copper foil”<br><br>Dobashi at Abstract.<br><br>“Further, the surface-treated electro-deposited copper foil according to the present invention can also be suitably used as the negative electrode current collector of a lithium ion secondary battery.”<br><br>Dobashi at 22:21-24.<br><br>Dobashi discloses a copper foil having two surfaces:<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11.”<br><br>Dobashi at 17:43-44. |

| ’014 Patent | Dobashi |
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| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first protective layer at the first surface; | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer at the first surface.<br><br>For example:<br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.”<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15. |

| ’014 Patent | Dobashi |
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| | “Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second protective layer at the second surface; and | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer at the second surface; and<br><br>For example:<br><br>“A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm.” |

| ’014 Patent | Dobashi |
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| | “The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>“Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds.”<br><br>Dobashi at 17:43-54.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a copper film disposed between the | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a copper film disposed between the first and second protective layers. |

| **'014 Patent** | **Dobashi** |
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| first and second protective layers, wherein | For example:<br><br>"A surface-treated electro-deposited copper foil according to the present invention: A surface-treated electro-deposited copper foil according to the present invention is a surface-treated electro-deposited copper foil in which any one or more of rust-proofing treatment and/or silane coupling agent treatment are performed on the surface of an electro-deposited copper foil, characterized in that the maximum waviness height (Wmax) of the bonding surface in the surface-treated electro-deposited copper foil to be bonded with an insulation layer-constituting material is 0.05 μm to 0.7 μm."<br><br>"The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage."<br><br>Dobashi at 7:3-15.<br><br>"Rust-proofing treatment was provided to both surfaces of each of the electro-deposited copper foils prepared in Example 1 to Example 11. Here, inorganic rust-proofing with conditions described below was applied. Zinc rust-proofing, using a zinc sulfate bath with a free sulfuric acid concentration of 70 g/L and a zinc concentration of 20 g/L, a solution temperature of 40° C., and an electric current density of 15 A/dm2 was performed. Further, after the zinc rust-proofing was performed, chromate rust-proofing was performed by electrolysis. The electrolysis conditions at this time were a chromic acid concentration of 5.0 g/L, a pH of 11.5, a solution temperature of 35° C., an electric current density of 8 A/dm2, and an electrolysis time of 5 seconds."<br><br>Dobashi at 17:43-54. |

| ’014 Patent | Dobashi |
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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak | Dobashi discloses (at least based on SKN’s apparent interpretation of the claims) a binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer).<br><br>For example:<br><br>Dobashi discloses each of Rp, peak density, and use of Chromium:<br><br>“It is an object to provide a surface-treated electro-deposited copper foil which has a low profile at a level equal to or excellent than that of low-profile surface-treated electro-deposited copper foils that have conventionally been supplied to the market and in which waviness affecting the straight line performance of wiring is small, and a method for manufacturing the same. In order to achieve this object, in the surface-treated electro-deposited copper foil, the maximum waviness height (Wmax) of the bonding surface to be bonded with an insulation layer-constituting material to be 0.05 μm to 0.7 μm, the maximum peak to valley height (PV) to be 0.05 to 1.5 μm, and the surface roughness (Rzjis) to be 0.1 μm to 1.0 μm. The electro-deposited copper foil used for the manufacturing of this surface-treated electro-deposited |

| **'014 Patent** | **Dobashi** |
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| density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer). | copper foil is manufactured by using a sulfuric acid base copper electrolytic solution obtained by adding 3-mercapto-1-propanesulfonic acid or bis(3-sulfopropyl)disulfide, a quaternary ammonium salt polymer having a cyclic structure, and chlorine, and using a cathode having small surface roughness, under electrolysis conditions of carrying out continuous first-step electrolysis to n-th-step electrolysis at two or more different levels of electric current density."<br><br>*Dobashi* at Abstract.<br><br>"1. A surface-treated electro-deposited copper foil comprising:<br>a deposit side of the electro-deposited copper foil having a surface roughness Rzjis of 0.1 μm to 1.0 μm, and a gloss [Gs(60°)] of 400 or more, wherein the deposit side of the electro-deposited copper foil is subjected to at least one surface treatment selected from a rust-proofing treatment and a silane coupling agent treatment; and"<br><br>*Id*. at claim 1.<br><br>"2. The surface-treated electro-deposited copper foil according to claim 1, wherein a surface roughness (Rzjis) of the bonding surface is 0.1 μm to 1.0 μm."<br><br>*Id*. at claim 2.<br><br>"5. An electro-deposited copper foil used for manufacturing of the surface-treated electro-deposited copper foil according to claim 1, characterized in that surface roughness (Rzjis) of a shiny side of the electro-deposited copper foil is 0.4 μm to 2.0 μm."<br><br>*Id*. at claim 5.<br><br>"Therefore, since RSm (JIS B 0601, 2001) obtained by using the stylus-type roughness meter can be adopted as the period of waviness, RSm can also be used as an indicator for judgment of the surface. The surface has small waviness and is smooth when RSm is large, and the surface has large waviness and is rough when RSm is small." |

| ’014 Patent | Dobashi |
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| | Dobashi at 6:13-29; *see* ’090 Patent Claim 1[d] and ’706 1[c] explanations.<br><br>“The rust-proofing treatment provided to the electro-deposited copper foil is carried out to prevent the surface of the surface-treated electro-deposited copper foil from being oxidized and corroded, to prevent from suffering the process of manufacturing a copper clad laminate and a printed wiring board. Further, a composition that does not inhibit adhesion with the insulation layer-constituting material and preferably improves the adhesion is recommended. For a method used in the rust-proofing treatment, any of organic rust-proofing using benzotriazole, imidazole, or the like, or inorganic rust-proofing treatment using zinc, chromate, a zinc alloy, or the like may be used, as long as it is recommended to the purpose of usage.”<br><br>Dobashi at 7:3-15.<br><br>A person of ordinary skill would thus be able to calculate the binding coefficient using these properties.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second | To the extent that this limitation is not disclosed, either explicitly or inherently, by Dobashi, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Dobashi |
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| surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes | |

| **’014 Patent** | **Dobashi** |
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| (111), (200), (220), and (311) crystal planes, | |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Dobashi*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

# Appendix A5

**EXHIBIT A-5**

U.S. Patent Publication No. 2010/0136434 to Hanafusa et al. ("Hanafusa") (*see* Bates Nos. PRIOR_ART-00000463-PRIOR_ART-00000469), filed on April 8, 2008 and published on June 3, 2010, qualifies as prior art under at least 35 U.S.C. §§ 102 and/or 103 for the asserted claims of U.S. Patent No. 10,811,541 ("the '541 patent"), as discussed in detail in the claim chart below.

The Court has not yet construed the claims and therefore the meaning of the terms in the claims has yet to be resolved by the Court. The support identified herein may be responsive at least in part to Plaintiff's infringement contentions, with which Defendants disagree. As such, nothing in Defendants' claim charts should be construed as an admission regarding infringement, either literally or under the doctrine of equivalents, or as an admission regarding Defendants' understanding of the proper scope of the asserted claims. Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff 's infringement contentions, and/or information obtained during discovery as the case progresses.

To the extent Plaintiff alleges that *Hanafusa* does not disclose any particular limitation of the asserted claims of the '541 patent, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the '541 patent to modify *Hanafusa* and/or to combine the teachings of *Hanafusa* with the knowledge of a person of ordinary skill in the art and/or one or more references identified in Defendants' Invalidity Contentions, including but not limited to the present prior art references cited in the Cover Pleading and the relevant section(s) of claim charts for other prior art references for the '541 patent in a manner that would have rendered the asserted claims invalid as obvious.

Where Defendants cite a particular figure, such citation should be understood to encompass the caption and description of the figure and any text relating to the figure, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Defendants reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Cover Pleading, based on, for example and without limitation, subsequent discovery, any amendments to the pleadings, or rulings from the Court.

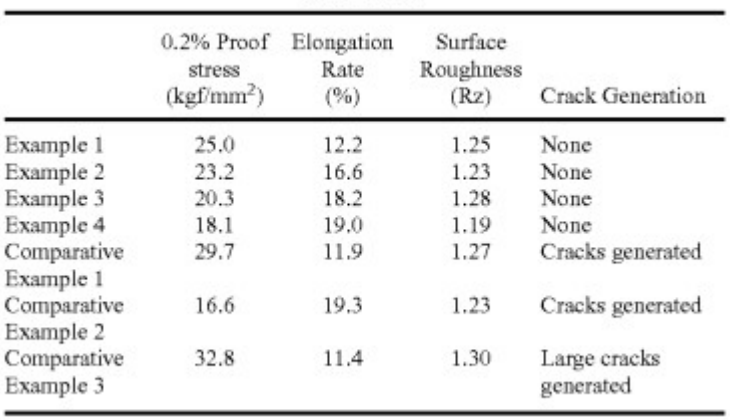
| **'541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
|---|---|
| [1pre] A copper foil for a current collector of a lithium secondary battery, wherein, | To the extent the preamble of claim 1 is found to be limiting, *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) a copper foil for a current collector of a lithium secondary battery.<br><br>For example:<br><br>"**1**. An electrolytic copper foil for a lithium rechargeable battery, wherein its 0.2% proof stress is 18 to 25 kgf/mm$^2$ and its elongation rate is 12.2% or more."<br>*Hanafusa* at claim 1.<br><br>"**2**. The electrolytic copper foil for a lithium rechargeable battery according to claim 1, wherein its elongation rate is 12.2 to 19%.<br>**3**. The electrolytic copper foil for a lithium rechargeable battery according to claim 2, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.<br><br>**4**. The electrolytic copper foil for a lithium rechargeable battery according to claim 3, wherein the surface roughness Rz of the electrolytic copper foil is 1.0 to 2.0 μm.<br><br>**5**. The electrolytic copper foil for a lithium rechargeable battery according to claim 4, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m$^2$."<br>*Id*. at claims 2, 3, 4, 5.<br><br>"An electrolytic copper foil for a lithium rechargeable (secondary) battery, wherein the 0.2% proof stress is 18 to 25 kgf/mm$^2$ and the elongation rate is 10% or more; and a process for producing an electrolytic copper foil for a lithium rechargeable battery, wherein an electrolytic copper foil whose 0.2% proof stress is 18 to 25 kgf/mm$^2$ and elongation rate is 10% or more is manufactured by subjecting the electrolytic copper foil to an annealing treatment at a temperature within the range of 175° C. to 300° C. "<br>*Hanafusa* at Abstract. |

| ’541 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | “The present invention provides such an electrolytic copper foil used for a lithium rechargeable battery that has good proof stress and elongation rate and will not be easily broken due to electrode breakage caused by charge and discharge of the lithium rechargeable battery; and the invention also provides a process for producing such an electrolytic copper foil.”<br>*Id*. at Abstract.<br><br>“The present invention relates to an electrolytic copper foil used for such a negative current collector for a lithium rechargeable (secondary) battery that will not be easily broken due to electrode breakage caused by charge and discharge of the lithium rechargeable battery; and the invention also relates to a process for producing such an electrolytic copper foil.”<br>*Id*. at [0001].<br>“The present invention provides such an electrolytic copper foil for a lithium rechargeable battery that has good proof stress and elongation rate and will not be easily broken due to electrode breakage caused by repeated charge and discharge of the lithium rechargeable battery; and the invention also provides a process for producing such an electrolytic copper foil.”<br>*Id*. at [0007]<br><br>“As a result of thorough examinations to solve the above-described problem, the inventors found that such an electrolytic copper foil for a lithium rechargeable battery that has good proof stress and elongation rate and will not be easily broken can be obtained by subjecting the electrolytic copper foil to an annealing treatment at a specified temperature, and electrode breakage caused by repeated charge and discharge can be prevented in a negative current collector for the lithium rechargeable battery using the electrolytic copper foil. Structure requirement and properties of the electrolytic copper foil having the electrode breakage prevention effect are as described below.”<br>*Id*. at [0008].<br><br>“Based on the above-described finding, the present invention provides:<br>1) A copper foil for a lithium rechargeable battery, whose 0.2% proof stress is 18 to 25 kgf/mm2 and elongation rate is 10% or more.” |

| ’541 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | *Id*. at [0009].<br><br>“The present invention also provides:<br>3) An electrolytic copper foil for a lithium rechargeable battery, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.”<br>*Id*. at [0011].<br><br>“Furthermore, the present invention provides:<br><br>4) The copper foil for a lithium rechargeable battery according to any one of paragraphs 1) to 3) above, wherein the surface roughness Rz of the copper foil is 1.0 to 2.0 μm. “<br>*Id*. at [0012].<br><br>“Furthermore, the present invention provides:<br>5) The electrolytic copper foil for a lithium rechargeable battery according to any one of paragraphs 1) to 4) above, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2.”<br>*Id*. at [0013].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are |

| **'541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, wherein the texture coefficient satisfies the following equation: TC(hkl)≥$I$(hkl)$I$0(hkl)1$n\Sigma I$(hkl)$I$0(hkl) wherein I(hkl) represents a measured diffraction intensity with respect to a (hkl) surface, and I0(hkl) represents a standard diffraction intensity of ASTM (American Society of Testing Materials) standard powder-shaped diffraction data, | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] wherein the copper foil has a weight deviation of 3% or less, and | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the copper foil has a weight deviation of 3% or less, and |

| **'541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
|---|---|
| | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] wherein the copper foil has a tensile strength of 30 to 40 kgf/mm$^2$, | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the copper foil has a tensile strength of 30 to 40 kgf/mm$^2$.<br><br>For example:<br><br>"An electrolytic copper foil for a lithium rechargeable (secondary) battery, wherein the 0.2% proof stress is 18 to 25 kgf/mm2 and the elongation rate is 10% or more; and a process for producing an electrolytic copper foil for a lithium rechargeable battery, wherein an electrolytic copper foil whose 0.2% proof stress is 18 to 25 kgf/mm2 and elongation rate is 10% or more is manufactured by subjecting the electrolytic copper foil to an annealing treatment at a temperature within the range of 175° C. to 300° C."<br>*Hanafusa* at Abstract.<br><br>"1. An electrolytic copper foil for a lithium rechargeable battery, wherein its 0.2% proof stress is 18 to 25 kgf/mm2 and its elongation rate is 12.2% or more."<br>*Id*. at claim 1.<br><br>"As described above, the electrolytic copper foil for a lithium rechargeable battery is require to have 0.2% proof stress of 18 to 25 kgf/mm2 and |

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| | elongation rate of 10% or more. If the 0.2% proof stress is less than 18 kgf/mm2, the electrolytic copper lacks strength and it may cause crack generation. If the 0.2% proof stress exceeds 25 kgf/mm2, flexibility is lost and it may cause crack generation, so this becomes a problem.”<br>*Id*. at [0026].<br><br>TABLE 1<br>  <br>“(Tensile Strength Test)<br>[0054]<br>The heat-treated copper foil was cut into a piece which was 150 mm long and 12.7 mm wide. Then, a tensile test was performed at a distance between chucks of 50 mm and a tensile rate of 50 mm/min. Table 1 shows 0.2% proof stress and elongation rate based on the obtained stress-strain curve.<br>[0055]<br>In Comparative Example 1, the 0.2% proof stress was 29.7 kgf/mm2 which was large and was a bad result that did not satisfy the condition specified for the present invention.<br>[0056] |

| | 0.2% Proof stress ($kgf/mm^2$) | Elongation Rate (%) | Surface Roughness (Rz) | Crack Generation |
|---|---|---|---|---|
| Example 1 | 25.0 | 12.2 | 1.25 | None |
| Example 2 | 23.2 | 16.6 | 1.23 | None |
| Example 3 | 20.3 | 18.2 | 1.28 | None |
| Example 4 | 18.1 | 19.0 | 1.19 | None |
| Comparative Example 1 | 29.7 | 11.9 | 1.27 | Cracks generated |
| Comparative Example 2 | 16.6 | 19.3 | 1.23 | Cracks generated |
| Comparative Example 3 | 32.8 | 11.4 | 1.30 | Large cracks generated |

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| | In Comparative Example 2, the elongation rate was large, but the 0.2% proof stress was 16.6 kgf/mm2 which was small and was a bad result that did not satisfy the condition specified for the present invention.<br>[0057]<br>In Comparative Example 3, the 0.2% proof stress was 32.8 kgf/mm2 which was extremely large and was a bad result that did not satisfy the condition specified for the present invention.”<br>*Id*. at [0054]-[0057].<br><br>“As is apparent from the above results, no cracks were generated after the charge-discharge test on the electrolytic copper foil whose 0.2% proof stress was 18 to 25 kgf/mm2. In this case, the elongation rate tends to decrease with an increase of the proof stress; however, if the 0.2% proof stress is within the range of 18 to 25 kgf/mm2, the elongation rate is 10% or more and cracks will not be generated.”<br>*Id*. at [0060].<br><br>“The present invention adjusts the 0.2% proof stress to 18 to 25 kgf/mm2 and the elongation rate to 10% or more by subjecting the electrolytic copper foil to the annealing treatment at a temperature within the range of 175° C. to 300° C. In this case, the grain size increases from fine particles to coarse particles, and it was confirmed that such grain size increase is a favorable condition and has the optimum crack prevention effect.”<br>*Id*. at [0062].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable |

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| | solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] so as to prevent the generation of wrinkles at a surface of the copper foil. | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less. | *Hanafusa discloses* or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less.<br><br>For example:<br><br>"4. The electrolytic copper foil for a lithium rechargeable battery according to claim 3, wherein the surface roughness Rz of the electrolytic copper foil is 1.0 to 2.0 μm."<br>*Hanafusa* at claim 4.<br><br>" Furthermore, the present invention provides: |

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| | 4) The copper foil for a lithium rechargeable battery according to any one of paragraphs 1) to 3) above, wherein the surface roughness Rz of the copper foil is 1.0 to 2.0 μm. Large surface roughness is not favorable for prevention of breakage because it could easily cause generation of cracks. Therefore, it is desirable that the surface roughness Rz of the copper foil is 2.0 μm or less. If the surface roughness Rz of the copper foil is less than 1.0 μm, adhesion to a negative-electrode material tends to decrease. Therefore, it is more preferable that the surface roughness Rz is 1.0 μm or more.”<br>*Id*. at [0012].<br><br>“The present invention provides a copper foil for a lithium rechargeable battery on a preferable condition that surface roughness Rz of the electrolytic copper foil is 1.0 to 2.0 μm. The surface roughness of the electrolytic copper foil can be adjusted by an additive to the electrolyte, and known methods for adjusting the surface roughness can be arbitrarily used. Also, the surface roughness to be adjusted means roughness of both sides of the copper foil. [0029]<br>Large surface roughness is not favorable in terms of prevention of breakage. This is because large surface roughness may cause cracks. Therefore, it is desirable that the surface roughness Rz of the electrolytic copper foil is 2.0 μm or less. If the surface roughness Rz of the copper foil is less than 1.0 μm, adhesion to a negative-electrode material tends to decrease. Therefore, it is desirable that the surface roughness Rz is 1.0 μm or more.”<br>*Id*. at [0028]-[0029]. |

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TABLE 1

| | 0.2% Proof stress ($kgf/mm^2$) | Elongation Rate (%) | Surface Roughness (Rz) | Crack Generation |
|---|---|---|---|---|
| Example 1 | 25.0 | 12.2 | 1.25 | None |
| Example 2 | 23.2 | 16.6 | 1.23 | None |
| Example 3 | 20.3 | 18.2 | 1.28 | None |
| Example 4 | 18.1 | 19.0 | 1.19 | None |
| Comparative Example 1 | 29.7 | 11.9 | 1.27 | Cracks generated |
| Comparative Example 2 | 16.6 | 19.3 | 1.23 | Cracks generated |
| Comparative Example 3 | 32.8 | 11.4 | 1.30 | Large cracks generated |

> “Although there is not so obvious contrast, if the surface roughness (Rz) is less than 1.0 μm, the adhesion of the copper foil to the negative-electrode material is weak and the copper foil will come off as a result of the charge-discharge test. If the surface roughness Rz is larger than 2.0 μm, a difference in the roughness between the front side and the back side of the copper foil becomes large and it is difficult to apply the negative-electrode material uniformly on both sides of the copper foil. Therefore, the electrolytic copper foil with the surface roughness Rz within the range of 1.0 to 2.0 μm exhibits particularly good property.”

*Id*. at [0061]

To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable

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| | solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%. | *Hanafusa* discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%.<br><br>For example:<br><br>"An electrolytic copper foil for a lithium rechargeable (secondary) battery, wherein the 0.2% proof stress is 18 to 25 kgf/mm2 and the elongation rate is 10% or more;"<br>*Hanafusa* at Abstract.<br><br>"1. An electrolytic copper foil for a lithium rechargeable battery, wherein its 0.2% proof stress is 18 to 25 kgf/mm2 and its elongation rate is 12.2% or more.<br>2. The electrolytic copper foil for a lithium rechargeable battery according to claim 1, wherein its elongation rate is 12.2 to 19%.<br>6. A process for producing an electrolytic copper foil for a lithium rechargeable battery, wherein an electrolytic copper foil whose 0.2% proof stress is 18 to 25 kgf/mm2 and elongation rate is 12.2% or more is manufactured by subjecting the electrolytic copper foil to an annealing treatment at a temperature within the range of 175° C. to 300° C.<br>7. The process for producing the electrolytic copper foil for a lithium rechargeable battery according to claim 6, wherein elongation rate of the electrolytic copper foil is 12.2 to 19%."<br>*Id*. at cls. 1,2,6,7. |

| **’541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | “A suggested conventional technique relates to an electrolytic copper foil with a low rough surface, whose surface roughness is 2.0 μm or less and elongation rate at a temperature of 180° C. is 10.0% or more, and that is to be used for a printed-wiring board or a negative current collector for a rechargeable (secondary) battery (see Patent Document 1).”<br>*Id*. at [0006].<br><br>“Based on the above-described finding, the present invention provides:<br>1) A copper foil for a lithium rechargeable battery, whose 0.2% proof stress is 18 to 25 kgf/mm2 and elongation rate is 10% or more.<br>[0010]<br>The electrolytic copper foil having the effect of preventing electrode breakage needs to have sufficient proof stress as an indicator of resistance to breakage and be flexible for expansion and contraction. The requirements for the present invention satisfy these conditions.<br>2) It is more preferable that the copper foil for a lithium rechargeable battery according to paragraph 1) above has elongation rate of 10 to 19%”<br>*Id*. at [0009]-[0010].<br><br>“As described above, the electrolytic copper foil for a lithium rechargeable battery is require to have 0.2% proof stress of 18 to 25 kgf/mm2 and elongation rate of 10% or more. If the 0.2% proof stress is less than 18 kgf/mm2, the electrolytic copper lacks strength and it may cause crack generation. If the 0.2% proof stress exceeds 25 kgf/mm2, flexibility is lost and it may cause crack generation, so this becomes a problem. The electrolytic copper foil having the effect of preventing electrode breakage is required to have sufficient proof stress, which is an indicator of resistance to breakage, and be flexible for expansion and contraction.<br>[0027] |

| **'541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | In that sense, the electrolytic copper foil is required to have elongation rate of 10% or more. Furthermore, the elongation rate of 10 to 19% is a favorable condition."<br>*Id*. at [0026]-[0027].<br><br>"Each of the followings; the electrolytic copper foil for a lithium rechargeable battery having 0.2% proof stress of 18 to 25 kgf/mm2 and elongation rate of 10% or more, and the manufacturing method for obtaining such an electrolytic copper foil; is independent and the most important condition for the present invention. The present invention provides this electrolytic copper foil for a lithium rechargeable battery."<br>*Id*. at [0034].<br><br>TABLE 1<br><br>0.2% Proof stress ($kgf/mm^2$) \| Elongation Rate (%) \| Surface Roughness (Rz) \| Crack Generation<br>Example 1 \| 25.0 \| 12.2 \| 1.25 \| None<br>Example 2 \| 23.2 \| 16.6 \| 1.23 \| None<br>Example 3 \| 20.3 \| 18.2 \| 1.28 \| None<br>Example 4 \| 18.1 \| 19.0 \| 1.19 \| None<br>Comparative Example 1 \| 29.7 \| 11.9 \| 1.27 \| Cracks generated<br>Comparative Example 2 \| 16.6 \| 19.3 \| 1.23 \| Cracks generated<br>Comparative Example 3 \| 32.8 \| 11.4 \| 1.30 \| Large cracks generated<br><br>"As is apparent from the above results, no cracks were generated after the charge-discharge test on the electrolytic copper foil whose 0.2% proof stress was 18 to 25 kgf/mm2. In this case, the elongation rate tends to decrease with an increase of the proof stress; however, if the 0.2% proof stress is |

| **’541 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | within the range of 18 to 25 kgf/mm2, the elongation rate is 10% or more and cracks will not be generated.”<br>*Id*. at [0060].<br><br>“The present invention adjusts the 0.2% proof stress to 18 to 25 kgf/mm2 and the elongation rate to 10% or more by subjecting the electrolytic copper foil to the annealing treatment at a temperature within the range of 175° C. to 300° C. In this case, the grain size increases from fine particles to coarse particles, and it was confirmed that such grain size increase is a favorable condition and has the optimum crack prevention effect.”<br>*Id*. at [0062].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm. | *Hanafusa* discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm.<br><br>For example: |

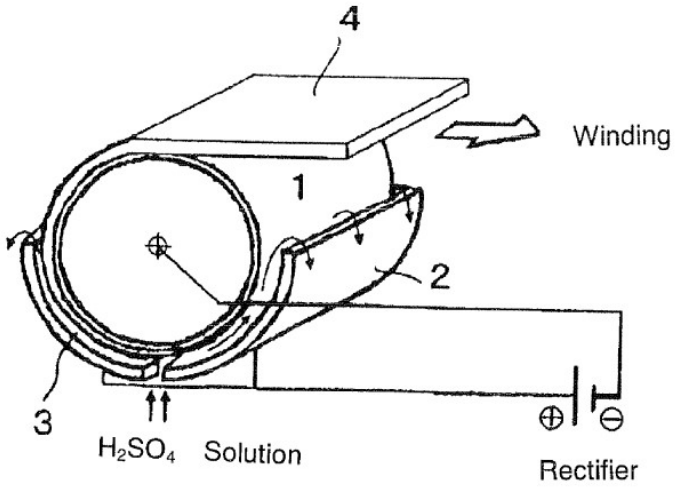
| ’541 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | “3. The electrolytic copper foil for a lithium rechargeable battery according to claim 2, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.<br>8. The process for producing the electrolytic copper foil for a lithium rechargeable battery according to claim 7, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.<br>9. The process for producing the electrolytic copper foil for a lithium rechargeable battery according to claim 6, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.<br>10. The electrolytic copper foil for a lithium rechargeable battery according to claim 1, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm.”<br>*Hanafusa* at claims 3, 8, 9, 10.<br><br>“3) An electrolytic copper foil for a lithium rechargeable battery, wherein the foil thickness of the electrolytic copper foil is 9.5 to 12.5 μm. The above-mentioned thickness of the electrolytic copper foil is an optimum thickness for the use in a lithium rechargeable battery, and such thickness can be achieved according to this invention. It is possible to make adjustments, if necessary, to obtain a thickness thinner or thicker than the above-described range of thickness. The present invention does not limit the thickness of the electrolytic copper foil to the above-mentioned range of thickness, but includes the above-mentioned range of thickness.”<br>*Id*. at [0011].<br><br>“An electrolytic copper foil was manufactured using an apparatus, as shown in FIG. 1, capable of continuously manufacturing the electrolytic copper foil at a drum-type cathode used for commercial production. An electrolyte contained 85 g/L of copper, 75 g/L of sulfuric acid, 60 mg/L of chloride ions, 3-10 ppm of bis-(3-sulfopropyl)-disulfide sodium salt, and 2-20 ppm of |

| ’541 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
|---|---|
| | nitride-containing organic compound. The liquid temperature of the electrolyte was 53° C., the linear velocity of the electrolyte was 1.0 m/min, and the current density was 50 A/dm2. The foil thickness of the electrolytic copper foil was 9.5 to 12.5 μm”<br>*Id*. at [0037].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

**Invalidity of U.S. Patent No. 10,480,090 in View of U.S. 20,100,136,434 (*Hanafusa*)**

| ’090 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| [1pre] An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, for a secondary battery.<br><br>For example:<br><br>*See* disclosures for ’541 patent [1pre]. |

| **’090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
|---|---|
| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first surface; | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a first surface.<br><br>For example: |

| ’090 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
|---|---|
| | [Figure 1]<br>  <br><br>“As the cathode drum 1 rotates, the thickness of the copper electrodeposited from the electrolyte increases; and when the thickness of the electrodeposited copper reaches a certain value or more, this raw copper foil 4 is peeled off and continuously wound up. The thickness of the raw copper foil manufactured in this manner is adjusted by the distance between the cathode drum 1 and the anode 2, a flow rate of the supplied electrolyte, or the quantity of supplied electricity.”<br>*Hanafusa* at [0021].<br><br>“Regarding the copper foil manufactured by the above-described electrolytic copper foil manufacturing apparatus, a **surface of the copper foil in contact with the cathode drum becomes a mirror surface, while the other surface becomes a rough surface** with asperity.” |

| **’090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | *Id*. at [0022].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second surface opposite to the first surface, | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example:<br><br>*See* disclosures for [1b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measures at randomly-selected three points, | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 µm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940), and | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable |

| **'090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] there is at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 1, wherein the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1. |

| **'090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less.<br><br>For example:<br><br>*See* disclosures for '541 Patent [Claim 2]<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm.<br><br>For example:<br><br>*See* disclosures for '541 patent [4].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill |

| **’090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4b] and tensile strength of 30 to 60 kgf/mm2. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) tensile strength of 30 to 60 kgf/mm2.<br><br>For example:<br><br>*See* disclosures for ’541 patent [1c].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5pre] A current collector for a secondary battery, the current collector comprising: | To the extent the preamble of claim 5 is found to be limiting, *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a current collector for a secondary battery. |

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| | For example:<br><br>“The present invention relates to an electrolytic copper foil used for such a negative current collector for a lithium rechargeable (secondary) battery that will not be easily broken due to electrode breakage caused by charge and discharge of the lithium rechargeable battery; and the invention also relates to a process for producing such an electrolytic copper foil.”<br>*Hanafusa* at [0001].<br><br>“A suggested conventional technique relates to an electrolytic copper foil with a low rough surface, whose surface roughness is 2.0 μm or less and elongation rate at a temperature of 180° C. is 10.0% or more, and that is to be used for a printed-wiring board or a negative current collector for a rechargeable (secondary) battery (see Patent Document 1).”<br>*Id*. at [0006].<br><br>“Since an electrolytic copper foil according to the present invention used for a negative current collector of a lithium rechargeable battery has good proof stress and elongation rate, it will not be easily broken even after repeated charge and discharge of the battery and has the excellent effect of remarkably improving the charge-discharge cycle property.”<br>*Id*. at [0014].<br><br>“The present invention provides an electrolytic copper foil having good proof stress and elongation rate. A lithium rechargeable battery using the electrolytic copper foil as a negative current collector shows the excellent effect of having good charge-discharge cycle property.”<br>*Id*. at [0063].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the |

| **’090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5a] the electrolytic copper foil according to claim 1; and | *Hanafusa* discloses or renders the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5b] a protective layer disposed on the electrolytic copper foil, | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a protective layer disposed on the electrolytic copper foil.<br><br>For example:<br><br>“5. The electrolytic copper foil for a lithium rechargeable battery according to claim 4, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2. |

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| | 12. The electrolytic copper foil for a lithium rechargeable battery according to claim 11, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2.<br>14. The electrolytic copper foil for a lithium rechargeable battery according to claim 13, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2.<br>15. The electrolytic copper foil for a lithium rechargeable battery according to claim 1, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2.”<br>*Hanafusa* at claims 5, 12, 14, 15.<br><br>“Furthermore, the present invention provides:<br>5) The electrolytic copper foil for a lithium rechargeable battery according to any one of paragraphs 1) to 4) above, wherein a rust-proof chromium layer is provided on a surface of the electrolytic copper foil and a deposition amount of chromium in the rust-proof layer is 2.6 to 4.0 mg/m2. It is desirable that the rust-proof chromium layer is formed to prevent surface oxidation of the electrolytic copper foil. However, there is a possibility that an excessive deposition of chromium in this rust-proof layer may degrade the charge-discharge property of the lithium battery. Therefore, an optimum deposition amount of chromium is 2.6 to 4.0 mg/m2.”<br>*Id*. at [0013].<br><br>“The present invention provides an electrolytic copper foil having a rust-proof chromium layer whose chromium deposition amount is 2.6 to 4.0 mg/m2 as a preferable aspect. This is to prevent surface oxidation of the electrolytic copper foil. However, there is a possibility that chromium which prevents oxidation of the electrolytic copper foil may also be involved, as in |

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| | the case of zinc which has been conventionally used, in degradation of the charge-discharge property of the lithium battery. Therefore, it is necessary to keep the amount of chromium to the minimum. In other words, it is desirable that the chromium deposition amount should be decided in consideration of the above-described matter when forming the rust-proof chromium layer.<br>On the other hand, if the chromium deposition amount is less than 2.6 mg/m2, the copper foil will be easily oxidized. Specifically speaking, if the copper foil is left in the atmosphere for a long time, the copper foil will be oxidized and its charge-discharge property tends to degrade. Therefore, the chromium deposition amount should preferably be 2.6 mg/m2 or more in order to obtain the oxidation prevention effect by the rust-proof chromium layer. As a result, it can be said that the optimum chromium deposition amount is 2.6 to 4.0 mg/m2.<br>However, the rust-proof chromium layer is applied if the surface oxidation tends to easily occur when handling the electrolytic copper foil. If the risk of the surface oxidation is low or can be ignored, it is not particularly indispensable. In other words, it should be realized that the rust-proof chromium layer may be used arbitrarily if required. The present invention includes all the above-described aspects.”<br>*Id*. at [0031]-[0033]<br><br>“The obtained electrolytic copper foil was subjected to a surface oxidation prevention treatment so that the chromium deposition amount should be within the range of 2.6 to 4.0 mg/m2.”<br>*Id*. at [0038].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the |

| **'090 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5c] wherein the protective layer comprises at least one of chromate, benzotriazole, and a silane compound. | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) that the protective layer comprises at least one of chromate, benzotriazole, and a silane compound.<br><br>For example:<br><br>*See* disclosures for [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil. | *Hanafusa* discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 5, as set forth above with respect to claim 5.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) a protective layer that is formed on the first and second surfaces of the electrolytic copper foil. |

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| | For example:<br><br>*See* disclosures for [5b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1pre] An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising: | To the extent the preamble of claim 1 is found to be limiting, *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, which includes a first surface and a second surface opposite the first surface.<br><br>For example:<br><br>*See* disclosures for ’541 patent [1pre], [1a].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill |

| ’689 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface; | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface.<br><br>For example:<br><br>“ Regarding the copper foil manufactured by the above-described electrolytic copper foil manufacturing apparatus, a surface of the copper foil in contact with the cathode drum becomes a mirror surface, while the other surface becomes a rough surface with asperity. Ordinary electrolysis has problems of a markedly uneven rough surface, a tendency of undercuts to be easily generated at the time of etching, and difficulty in making a fine pattern.” *Hanafusa* at [0022]<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1b] a first protective layer on the matte surface of the copper layer; and | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer on the matte surface of the copper layer.<br><br>For example:<br><br>*See* disclosures of ’090 Patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a second protective layer on the shiny surface of the copper layer, | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer on the shiny surface of the copper layer.<br><br>For example:<br><br>*See* disclosures of ’090 Patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the |

| **'689 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.), | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2, | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.).<br><br>For example:<br><br>*See* disclosures for '541 patent [1c].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the |

| **'689 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] a weight deviation of the electrolytic copper foil is 5% or less, | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1g] a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1h] each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less. | *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) that each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less.<br><br>For example: |

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| | *See* disclosures for ’541 Patent [Claim 2]<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) an elongation of 3% or more at room temperature.<br><br>For example:<br><br>*See* disclosures of ’541 Patent [Claim 3].<br><br>To the extent the limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the |

| **’689 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound.<br><br>For example:<br><br>*See* disclosures of ’090 [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.<br><br>For example: |

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| | *See* disclosures for ’541 patent [4].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion of 17.3 to 22 μm/(m-º C.). | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, wherein: | To the extent the preamble of claim 1 is found to be limiting, *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>*See* disclosures for '090 Patent [1a], [1b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32, $TC(220)= ((I(220))/(I_0 (220)))/(1/n \sum(I(hkl))/(I_0 (hkl)))$ | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a difference ($\|\Delta(Rz/Ra)\|$) between Rz/Ra at the first surface of the electrolytic copper | |

| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0<br><br>For example: |

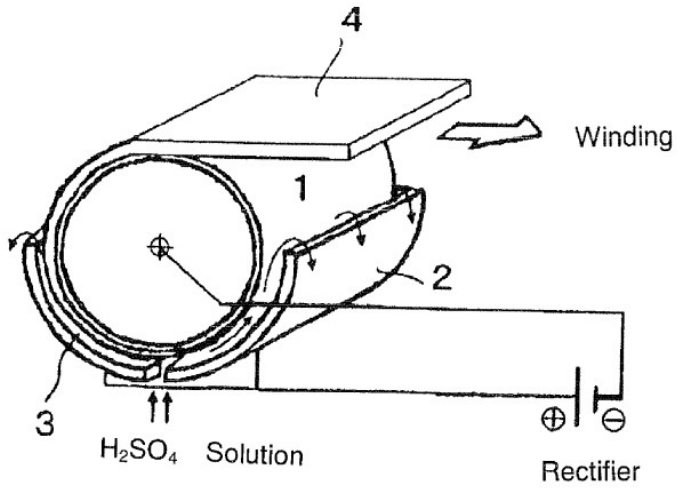
| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | "Regarding the copper foil manufactured by the above-described electrolytic copper foil manufacturing apparatus, a **surface of the copper foil in contact with the cathode drum becomes a mirror surface, while the other surface becomes a rough surface** with asperity."<br>*Id*. at [0022].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 2, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8.<br><br>For example:<br><br>"Regarding the copper foil manufactured by the above-described electrolytic copper foil manufacturing apparatus, a **surface of the copper foil in contact with the cathode drum becomes a mirror surface, while the other surface becomes a rough surface** with asperity."<br>*Id*. at [0022]. |

| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2.<br><br>For example:<br><br>*See* disclosures for '541 patent [1c].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| [Claim 5] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation measured at room temperature, of 3% or more.<br><br>For example:<br><br>*See* disclosures for '541 patent [Claim 3].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less. | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are |

| **'706 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'014 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, *Hanafusa* discloses (at least based on SKN's apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>*See* disclosures for '090 Patent [1a], [1b].<br>*See* disclosures for '541 Patent [1pre]. |

| ’014 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | [Figure 1]<br>  <br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first protective layer at the first surface; | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer at the first surface. |

| **’014 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
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| | For example:<br><br>*See* disclosures for ’090 Patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second protective layer at the second surface; and | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer at the second surface; and<br><br>For example:<br><br>*See* disclosures for ’090 Patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the |

| ’014 Patent | U.S. 20,100,136,434 (*Hanafusa*) |
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| | Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a copper film disposed between the first and second protective layers, wherein | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a copper film disposed between the first and second protective layers.<br><br>For example:<br><br>*See* disclosures for ’090 Patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, | *Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) a binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to |

| **’014 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
|---|---|
| wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer). | obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer).<br><br>For example:<br><br>*See* disclosures for ’541 Patent [Claim 2]<br>*See* disclosures of ’090 [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br>wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of | To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the |

| **’014 Patent** | **U.S. 20,100,136,434 (*Hanafusa*)** |
|---|---|
| the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes, | Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. | *Hanafusa* discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>*Hanafusa* discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature.<br><br>For example:<br><br>*See* disclosures for ’541 Patent [1c].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Hanafusa*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

# Appendix A10

**EXHIBIT A-10**

U.S. Patent No. 9,457,541, titled "Copper foil for current collector of lithium secondary battery with improved wrinkle characteristics" to named inventors are Dae-Young Kim et. al ("Kim '541") (*see* Bates Nos. PRIOR_ART-00001434-PRIOR_ART-00001439). The patent was issued on October 4, 2016, with a priority date of May 2, 2013 through Appl. No. US20130108887A1. This patent qualifies as prior art under at least 35 U.S.C. §§ 102 and/or 103 for the asserted claims of U.S. Patent Nos. 10,480,090 ("the '090 patent"), 10,811,689 ("the '689 patent), 11,591,706 (the '706 patent"), and 11,346,014 ("the '014 patent") as discussed in detail in the claim charts below.

The Court has not yet construed the claims and therefore the meaning of the terms in the claims has yet to be resolved by the Court. The support identified herein may be responsive at least in part to Plaintiff's infringement contentions, with which Defendants disagree. As such, nothing in Defendants' claim charts should be construed as an admission regarding infringement, either literally or under the doctrine of equivalents, or as an admission regarding Defendants' understanding of the proper scope of the asserted claims. Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff 's infringement contentions, and/or information obtained during discovery as the case progresses.

To the extent Plaintiff alleges that Kim '541 does not disclose any particular limitation of the asserted claims of the asserted patents, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the asserted patents to modify Kim '541 and/or to combine the teachings of Kim '541 with the knowledge of a person of ordinary skill in the art and/or one or more references identified in Defendants' Invalidity Contentions, including but not limited to the present prior art references cited in the Cover Pleading and the relevant section(s) of claim charts for other prior art references for the asserted patents in a manner that would have rendered the asserted claims invalid as obvious.

Where Defendants cite a particular figure, such citation should be understood to encompass the caption and description of the figure and any text relating to the figure, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Defendants reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Cover Pleading, based on, for example and without limitation, subsequent discovery, any amendments to the pleadings, or rulings from the Court.

**Invalidity of U.S. Patent No. 10,480,090 in View of Kim '541**

| '090 Patent | Kim '541 |
|---|---|
| [1pre] An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Kim '541 discloses (at least based on SKN's apparent interpretation of the claims) an electrolytic copper foil for a secondary battery.<br><br>For example:<br><br>"A copper foil for a current collector of a lithium secondary battery has a crystalline structure[.]"<br><br>Kim '541, Abstract.<br><br>> The present invention relates to a copper foil used as a current collector of a lithium secondary battery, and more particularly to a copper foil for a current collector of a lithium secondary battery, which has a structure capable of preventing the generation of wrinkles on a surface of the copper foil.<br><br>Kim '541 at 1:17-22 (Background of the Invention).<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim '541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first surface; | Kim '541 discloses (at least based on SKN's apparent interpretation of the claims) a first surface. |

| ’090 Patent | Kim ’541 |
|---|---|
| | For example:<br><br>Here, the copper foil is made by making an electrodeposited copper foil by means of electroplating and then conducting a post-processing to give peel strength to the original foil. **A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil**. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.<br><br>Kim ’541 at 1:41-52 (emphasis added).<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second surface opposite to the first surface, | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example:<br><br>Here, the copper foil is made by making an electrodeposited copper foil by means of electroplating and then conducting a post-processing to give peel strength to the original foil. **A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to** |

| ’090 Patent | Kim ’541 |
|---|---|
| | **a mountain structure is formed on the other side of the electrodeposited copper foil**. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.<br><br>Kim ’541 at 1:41-52 (emphasis added).<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

| ’090 Patent | Kim ’541 |
|---|---|
| measures at randomly-selected three points, | examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940), and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] there is at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

| **’090 Patent** | **Kim ’541** |
|---|---|
| second surfaces of 60 or less. | examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 1, wherein the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. The specification explains why a surface roughness $R_z$, measured according to the JIS (Japanese Industrial Standards) should not exceed 2 μm.<br><br>For example:<br><br>Claim 2 of the ’541 Patent limits Claim 1, disclosing a “copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (R2 -JIS) of 2 μm or less.”<br><br>*See also*:<br><br>> Surface roughness ($R_z$) of the copper foil should be 2 μm or less, based on JIS (Japanese Industrial Standards). In case the surface roughness ($R_z$) exceeds 2 μm, the surface is irregular, so a short circuit may occur during a charging or discharging process. In addition, the coating state of the anode active material becomes irregular.<br><br>Kim ’541 at 4:20-25.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

<table>
<tr><th>’090 Patent</th><th>Kim ’541</th></tr>
<tr><td></td><td>examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.</td></tr>
<tr><td>[4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm</td><td>Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm.<br><br>For example:<br><br>“In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, an elongation of 3 to 20%, and a thickness of 1 to 35 μm.” Kim ’541 at 4:40-42 9 (emphasis added).<br><br>Additionally, Table 1 provides seven (7) examples all with a thickness of 8 μm.<br><br>TABLE 1<br><table><tr><td></td><td colspan="7">Examples</td><td colspan="9">Comparative examples</td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>Copper foil</td><td colspan="16">Electrodeposited copper foil</td></tr><tr><td>Thickness of copper foil [μm]</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td></tr><tr><td>(111) + (200) ratio [%]</td><td>76</td><td>62</td><td>83</td><td>70</td><td>72</td><td>81</td><td>66</td><td>64</td><td>73</td><td>62</td><td>83</td><td>87</td><td>57</td><td>80</td><td>75</td><td>76</td></tr><tr><td>(111) ratio [%]</td><td>26</td><td>31</td><td>32</td><td>20</td><td>35</td><td>22</td><td>36</td><td>16</td><td>41</td><td>37</td><td>19</td><td>34</td><td>26</td><td>30</td><td>23</td><td>25</td></tr><tr><td>(200) ratio [%]</td><td>50</td><td>31</td><td>51</td><td>50</td><td>36</td><td>59</td><td>30</td><td>48</td><td>32</td><td>25</td><td>64</td><td>53</td><td>31</td><td>49</td><td>51</td><td>50</td></tr></table></td></tr>
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| **’090 Patent** | **Kim ’541** |
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| | The claimed range of 3 to 20 μm is within the disclosed range of 1 to 35 μm. Furthermore, the disclosed electrodeposited copper foil examples with a thickness of 8 μm is within the claimed range of 3 to 20 μm.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4b] and tensile strength of 30 to 60 kgf/mm2. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) tensile strength of 30 to 60 kgf/mm2.<br><br>“In addition, the copper foil should satisfy the following conditions: **a tensile strength of 30 to 40 kgf/mm2**, an elongation of 3 to 20%, and a thickness of 1 to 35 μm.” Kim ’541 at 4:40-42 9 (emphasis added).<br><br>The disclosed range of 30 to 40 kgf/mm2 is within the claimed range of 30 to 60 kgf/mm2.<br><br>Additionally, Table 1 provides the tensile strength of 7 examples that range from 32.1 to 37.2 kg/mm2, all of which fall within the claimed range of 30 to 60 kgf/mm2. |

| ’090 Patent | Kim ’541 |
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TABLE 1

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Copper foil | Electrodeposited copper foil | | | | | | | | | | | | | | | |
| Thickness of copper foil [μm] | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| (111) + (200) ratio [%] | 76 | 62 | 83 | 70 | 72 | 81 | 66 | 64 | 73 | 62 | 83 | 87 | 57 | 80 | 75 | 76 |
| (111) ratio [%] | 26 | 31 | 32 | 20 | 35 | 22 | 36 | 16 | 41 | 37 | 19 | 34 | 26 | 30 | 23 | 25 |
| (200) ratio [%] | 50 | 31 | 51 | 50 | 36 | 59 | 30 | 48 | 32 | 25 | 64 | 53 | 31 | 49 | 51 | 50 |

TABLE 1-continued

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |
| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |
| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |
| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |

To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.

| **’090 Patent** | **Kim ’541** |
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| [5pre] A current collector for a secondary battery, the current collector comprising: | To the extent the preamble of claim 5 is found to be limiting, Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a current collector for a secondary battery.<br><br>> The copper foil for a current collector of a lithium secondary battery according to the present invention has excellent peel strength since a sufficient adhesive force is ensured when the copper foil is contacted with anode active material such as carbon-based slurry, so it is possible to realize a lithium secondary battery that may stably keep a battery capacity.<br><br>Kim ’541 at 5:46-52. *See also* Claim 1 (“ A copper foil for a current collector of a lithium secondary battery”)<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5a] the electrolytic copper foil according to claim 1; and | Kim ’541 discloses or renders the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’090 Patent** | **Kim ’541** |
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| | |
| [5b] a protective layer disposed on the electrolytic copper foil, | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a protective layer disposed on the electrolytic copper foil.<br><br>For example:<br><br>“Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.” Kim ’541 at 1:50-52.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5c] wherein the protective layer comprises at least one of chromate, benzotriazole, and a silane compound. | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) that the protective layer comprises at least one of chromate, benzotriazole, and a silane compound.<br><br>For example:<br><br>> As the plating conditions to obtain the crystalline structure, copper is electrodeposited onto a drum surface of a foil making machine with a current density of 30 to 80 ASD at a temperature of 30 to 60° C. to make an original foil, and a nodule is formed thereat as necessary. After that, the surface of the copper foil is finally chromated to prevent corrosion.<br><br>’541 Patent at 3:44-50. |

| **'090 Patent** | **Kim '541** |
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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim '541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil. | Kim '541 discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 5, as set forth above with respect to claim 5.<br><br>Kim '541 discloses (at least based on SKN's apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil.<br><br>For example:<br><br>> As the plating conditions to obtain the crystalline structure, copper is electrodeposited onto a drum surface of a foil making machine with a current density of 30 to 80 ASD at a temperature of 30 to 60° C. to make an original foil, and a nodule is formed thereat as necessary. After that, the surface of the copper foil is finally chromated to prevent corrosion.<br><br>'541 Patent at 3:44-50.<br><br>A POSITA would understand that both sides are plated.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim '541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which |

| ’090 Patent | Kim ’541 |
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| | are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’689 Patent | Kim ’541 |
|---|---|
| [1pre] An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, which includes a first surface and a second surface opposite the first surface.<br><br>See explanations provided above for ’090 Patent, Claim 1[pre], Claim 1[a], and Claim 1[b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface; | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a matte surface facing the first surface and a shiny surface facing the second surface.<br><br>For example:<br><br>**A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of** |

| ’689 Patent | Kim ’541 |
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| | **electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil**. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.<br><br>’541 Patent at 1:44-52. (emphasis added)<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a first protective layer on the matte surface of the copper layer; and | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer on the matte surface of the copper layer.<br><br>See explanation provided for ’090 Patent, Claim 6.<br><br>For example:<br><br>A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of<br>electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil. **Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness**. |

| ’689 Patent | Kim ’541 |
|---|---|
| | ’541 Patent at 1:44-52 (emphasis added).<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a second protective layer on the shiny surface of the copper layer, | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer on the shiny surface of the copper layer.<br><br>See explanation provided for ’090 Patent, Claim 6.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, |

<table>
<tr><th>’689 Patent</th><th>Kim ’541</th></tr>
<tr><td>analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.),</td><td>examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.</td></tr>
<tr><td>[1e] a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2,</td><td>Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) tensile strength of 30 to 60 kgf/mm2.<br><br>“In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, an elongation of 3 to 20%, and a thickness of 1 to 35 μm.” Kim ’541 at 4:40-42 9 (emphasis added).<br><br>The disclosed range of 30 to 40 kgf/mm2 is within the claimed range of 30 to 60 kgf/mm2.<br><br>Additionally, Table 1 provides the tensile strength of 7 examples that range from 32.1 to 37.2 kg/mm2, all of which fall within the claimed range of 30 to 60 kgf/mm2.<br><br>TABLE 1<br><table><tr><th></th><th colspan="7">Examples</th><th colspan="9">Comparative examples</th></tr><tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr><tr><td>Copper foil</td><td colspan="16">Electrodeposited copper foil</td></tr><tr><td>Thickness of copper foil [μm]</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td></tr><tr><td>(111) + (200) ratio [%]</td><td>76</td><td>62</td><td>83</td><td>70</td><td>72</td><td>81</td><td>66</td><td>64</td><td>73</td><td>62</td><td>83</td><td>87</td><td>57</td><td>80</td><td>75</td><td>76</td></tr><tr><td>(111) ratio [%]</td><td>26</td><td>31</td><td>32</td><td>20</td><td>35</td><td>22</td><td>36</td><td>16</td><td>41</td><td>37</td><td>19</td><td>34</td><td>26</td><td>30</td><td>23</td><td>25</td></tr><tr><td>(200) ratio [%]</td><td>50</td><td>31</td><td>51</td><td>50</td><td>36</td><td>59</td><td>30</td><td>48</td><td>32</td><td>25</td><td>64</td><td>53</td><td>31</td><td>49</td><td>51</td><td>50</td></tr></table></td></tr>
</table>

| ’689 Patent | Kim ’541 |
|---|---|
| | TABLE 1-continued<br><br>| | Examples | | | | | | | Comparative examples | | | | | | | | |<br>|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|<br>| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |<br>| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |<br>| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |<br>| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |<br>| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] a weight deviation of the electrolytic copper foil is 5% or less, | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a weight deviation of the electrolytic copper foil is 5% or less.<br><br>For example:<br><br>“Preferably, the copper foil has a weight deviation of 3% or less.” ’541 Patent at 2:25-26. |

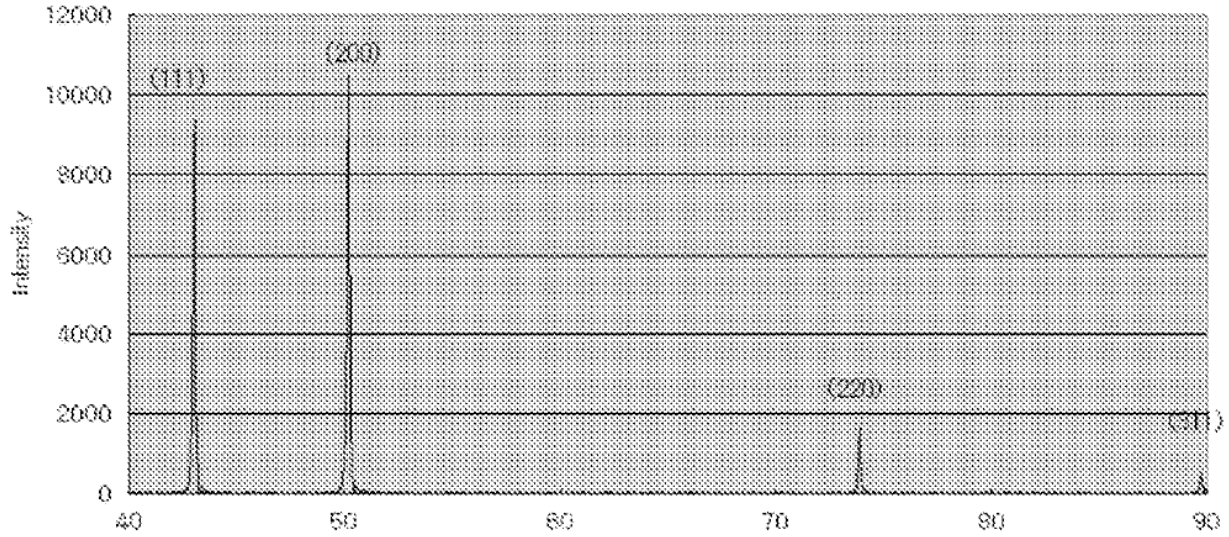
| ’689 Patent | Kim ’541 |
|---|---|
| | “The weight deviation of the copper foil should be 3% or less. If the weight deviation exceeds 3%, property deviations occur at the surface of the copper foil, which may increase the number of wrinkles and make properties of the current collector irregular. Here, the weight deviation is obtained by cutting a copper foil by an area of 5 cmx5 cm to make a test piece, measuring weight of the test piece and converting the weight into a weight of the copper foil per a unit area, cutting the test piece along a width direction of the copper foil, repeating the above processes to measure weights of copper foils of every test piece, and then calculating a standard deviation. At this time, the copper foil is preferably an electrodeposited copper foil that is surface-chromated for the prevention of corrosion.<br><br>The ’541 specification discloses a weight deviation of 3% or less, which is within the claimed 5% or less limitation. Furthermore, the ’541 specification teaches a POSITA why a low weight deviation is preferable for electrodeposited copper foil.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1g] a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1h] each of the first and second surfaces has | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) that each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less. |

| ’689 Patent | Kim ’541 |
|---|---|
| a surface roughness (Rz) of 3.5 μm or less. | See explanation provided for ’090 Patent, Claim 6.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses an elongation of 3% or more. For example:<br><br>“In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, **an elongation of 3 to 20%,** and a thickness of 1 to 35 μm.” Kim ‘541 at 4:40-42 9 (emphasis added).<br><br>Just as in ’541 Patent, the ’689 Patent, claim 2 provides 3% on the low end of elongation and attempts to capture<br><br>To the extent the limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’689 Patent | Kim ’541 |
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| [Claim 3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>See explanation for ’090 Patent, Claim 5[c].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.<br><br>*See* explanation provided for ’090 Patent, Claim 4.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’689 Patent | Kim ’541 |
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| [5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion of 17.3 to 22 µm/(m-º C.). | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’706 Patent | Kim ‘541 |
|---|---|
| [1pre] An electrolytic copper foil having a first surface and a second surface, wherein: | To the extent the preamble of claim 1 is found to be limiting, Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>*See* explanation provided for ’689 Patent, Claim 1[pre].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’706 Patent** | **Kim ‘541** |
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| [1a] a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br><br>The specification 4:1-2 describes considered planes are (111), (200), (220), (311)]<br>[Specification 3-4 describes use of JCPDS standards for standard copper power. Also describes “the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees”<br><br>Kim ’541 provides the planes that are (111), (200), (220), (311).<br><br>For example, Fig. 2:<br><br>FIG. 2<br>  <br> |

| ’706 Patent | Kim ‘541 |
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| | The specification also provides the calculation:<br><br>“In one aspect of the present invention, there is provided a copper foil for a current collector of a lithium secondary battery, wherein, in a crystalline structure, a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is to 40%.”<br><br>Kim ’541 at 2:11-22.<br><br>*See also id.* at 4:3-19:<br><br>“Here, the texture coefficient (TC) is determined by applying the X-ray diffraction (XRD) to obtain a diffraction intensity peak of each crystal surface as shown in FIG. 2 and then comparing the diffraction intensity peak with a criterion peak to convert it within the range defined by the following equation 1. In the equation 1, I(hkl) represents a measured diffraction intensity with respect to the (hkl) surface, and Io(hkl) represents a standard diffraction intensity of an ASTM (American Society of Testing Materials) standard powder-shaped diffraction data.<br><br>$$TC(hkl) \geq \frac{\frac{I(hkl)}{I_0(hkl)}}{\frac{1}{n}\Sigma\frac{I(hkl)}{I_0(hkl)}}$$ Equation 1 |

| ’706 Patent | Kim ‘541 |
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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a difference (\|Δ(Rz/Ra)\|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein the second surface | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would |

| **'706 Patent** | **Kim '541** |
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| is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0. | have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim '541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. | Kim '541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim '541 discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2.<br><br>*See* explanation for '090 Patent, Claim 4[b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim '541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable |

| ’706 Patent | Kim ‘541 |
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| | solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 5] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation measured at room temperature, of 3% or more.<br><br>*See* explanation provided for the ’689 Patent, Claim 2.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less. | Kim ’541 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less.<br><br>See explanation for ’689 Patent, Claim 1[f]. |

| ’706 Patent | Kim ‘541 |
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| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Kim ’541 |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>“A ‘copper foil smooth on both sides,’ which is an **electrodeposited copper foil for lithium-ion batteries**, has been developed during the optimization process because a decrease in the capacity retention rate occurred during repeated charge and discharge of the battery when the electrodeposited copper foil for a printed wiring board was used as the lithium-ion battery negative electrode collector.”<br><br>Kim ’541 at 229.<br><br>“In this paper, regarding the ‘copper foil smooth on both sides,’ which is being used for the lithium-ion battery negative electrode collector, its manufacturing process, mechanical characteristics, characteristics as a negative electrode collector, and recent trends are described.” |

| ’014 Patent | Kim ’541 |
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| | Kim ’541 at 231.<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first protective layer at the first surface; | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer at the first surface.<br><br>*See* explanation for ’689 Patent, Claim 1[b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ‘014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second protective layer at the second surface; and | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer at the second surface; and<br><br>*See* explanation for ’689 Patent, Claim 1[c].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one |

| ’014 Patent | Kim ’541 |
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| | of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a copper film disposed between the first and second protective layers, wherein | Kim ’541 discloses (at least based on SKN’s apparent interpretation of the claims) a copper film disposed between the first and second protective layers.<br><br>See explanation for ’090 Patent, Claim 5[b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’014 Patent** | **Kim ’541** |
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| = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) | |

| **’014 Patent** | **Kim ’541** |
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| with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer). | |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28, | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ’541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’014 Patent** | **Kim ’541** |
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| TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane | |

| **’014 Patent** | **Kim ’541** |
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| includes (111), (200), (220), and (311) crystal planes, | |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. | While the ’541 Patent does not explicitly disclose a yield strength, a POSITA would know that a yield strength will always be less than or equal to tensile strength.<br><br>“A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm.”<br>Kim ’541 at Abstract.<br><br>“…wherein the copper foil has a tensile strength of 30 to 40 kgf/mm2, so as to prevent the generation of wrinkles at a surface of the copper foil.”<br>*Id*. at claim 1. |

| **’014 Patent** | **Kim ’541** |
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TABLE 1-continued

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |
| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |
| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |
| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |

*Id*. at TABLE 1.

To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim ‘541, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B.

# Appendix A12

**EXHIBIT A-12**

U.S. Patent No. 2013/0108887, titled "Copper foil for current collector of lithium secondary battery with improved wrinkle characteristics," to Kim et al. ("Kim '887") (*see* Bates Nos. PRIOR_ART-00001429-PRIOR_ART-00001433), filed on December 20, 2012 and published on May 2, 2013, qualifies as prior art under at least 35 U.S.C. §§ 102 and/or 103 for the asserted claims of U.S. Patent Nos. 10,480,090 ("the '090 patent"), 10,811,689 ("the '689 patent), 11,591,706 (the '706 patent"), and 11,346,014 ("the '014 patent") as discussed in detail in the claim charts below.

The Court has not yet construed the claims and therefore the meaning of the terms in the claims has yet to be resolved by the Court. The support identified herein may be responsive at least in part to Plaintiff's infringement contentions, with which Defendants disagree. As such, nothing in Defendants' claim charts should be construed as an admission regarding infringement, either literally or under the doctrine of equivalents, or as an admission regarding Defendants' understanding of the proper scope of the asserted claims. Defendants reserve the right to rely on additional citations or sources of evidence that also may be applicable, or that may become applicable in light of claim construction, changes in Plaintiff 's infringement contentions, and/or information obtained during discovery as the case progresses.

To the extent Plaintiff alleges that Kim887 does not disclose any particular limitation of the asserted claims of the asserted patents, either expressly or inherently, it would have been obvious to a person of ordinary skill in the art as of the priority date of the asserted patents to modify Kim887 and/or to combine the teachings of Kim887 with the knowledge of a person of ordinary skill in the art and/or one or more references identified in Defendants' Invalidity Contentions, including but not limited to the present prior art references cited in the Cover Pleading and the relevant section(s) of claim charts for other prior art references for the asserted patents in a manner that would have rendered the asserted claims invalid as obvious.

Where Defendants cite a particular figure, such citation should be understood to encompass the caption and description of the figure and any text relating to the figure, in addition to the figure itself. Conversely, where a cited portion of text refers to a figure, the citation should be understood to include the figure as well.

Defendants reserve the right to amend or supplement this claim chart at a later date as more fully set forth in the Cover Pleading, based on, for example and without limitation, subsequent discovery, any amendments to the pleadings, or rulings from the Court.

**EXHIBIT A-12**

**Invalidity of U.S. Patent No. 10,480,090 in View of Kim 887**

| **'090 Patent** | **Kim 887** |
|---|---|
| [1pre] An electrolytic copper foil, for a secondary battery, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Kim887 discloses (at least based on SKN's apparent interpretation of the claims) an electrolytic copper foil for a secondary battery.<br><br>For example:<br><br>"In the lithium secondary battery, a copper foil is mostly used as material of the anode current collector, and the copper foil is generally coated with active material such as carbon-based slurry. Here, the copper foil is made by making an electrodeposited copper foil by means of electroplating and then conducting a post-processing to give peel strength to the original foil. A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness."<br>*Kim887* at [0007].<br><br>"Preferably, the copper foil for a current collector of a lithium secondary battery according to the present invention is made by adding a small amount of organic additives to a copper sulfate solution containing copper sulfate, sulfuric acid and chlorine. Here, the additive may be a sulfonate-based additive containing sulfide as a brightener to polish a plating surface and obtain a fine plating layer, gelatin having a low molecular weight of 1,000 to 100,000 as a leveler added to obtain a low roughness copper foil, or a cellulose-based additive serving as a suppressor to realize a stable low roughness. As the process condition, copper is electrodeposited on a drum surface of a foil making machine with a current density of 30 to 80 ASD (A/dm2) at a temperature of 30 to 60° C., and the surface of the copper foil is chromated to prevent corrosion."<br>*Id*. at [0024].<br><br>"As the plating conditions to obtain the crystalline structure, copper is electrodeposited onto a drum surface of a foil making machine with a current density of 30 to 80 ASD at a temperature of 30 to 60° |

| ’090 Patent | Kim 887 |
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| | C. to make an original foil, and a nodule is formed thereat as necessary. After that, the surface of the copper foil is finally chromated to prevent corrosion.”<br>*Id*. at [0025].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a first surface; | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a copper layer including a first surface.<br><br>For example:<br><br>“A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil.”<br>*Id*. at [0007].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **'090 Patent** | **Kim 887** |
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| [1b] a second surface opposite to the first surface, | Kim887 discloses (at least based on SKN's apparent interpretation of the claims) a second surface opposite to the first surface.<br><br>For example:<br><br>"A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil."<br>*Id*. at [0007].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein the peak count roughness Rpc of | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one |

| ’090 Patent | Kim 887 |
|---|---|
| each of the first and second surfaces is an average of peak count roughness Rpc values measures at randomly-selected three points, | of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] the peak count roughness Rpc of each point is the number of effective peaks with rise above an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel iron test schedule (SEP 1940), and | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] there is at least one valley deeper than a lower criteria line of -0.5 μm between adjacent ones of the effective peaks. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from |

| ’090 Patent | Kim 887 |
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| | known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein a difference in peak count roughness Rpc between the first and second surfaces of 60 or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 1, wherein the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the first and second surfaces has a ten-point mean roughness $R_{zJIS}$ of 2 μm or less.<br><br>For example:<br><br>“The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm.”<br>*Id*. at Abstract.<br><br>“2. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less.”<br>*Id*. at claim 2.<br><br>“Preferably, the copper foil has a surface roughness (Rz-JIS) of 2 μm or less.”<br>*Id*. at [0013]. |

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| | "Surface roughness (Rz) of the copper foil should be 2 μm or less, based on JIS (Japanese Industrial Standards). In case the surface roughness (Rz) exceeds 2 μm, the surface is irregular, so a short circuit may occur during a charging or discharging process. In addition, the coating state of the anode active material becomes irregular."<br>*Id*. at [0027].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm.<br><br>For example:<br><br>"A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm."<br>*Id*. at Abstract. |

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| | “The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm.”<br>*Id*. at claim 6.<br><br>“Preferably, the copper foil has a thickness of 1 to 35 μm.”<br>*Id*. at [0017].<br><br>“In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, an elongation of 3 to 20%, and a thickness of 1 to 35 μm.”<br>*Id*. at [0029].<br><br>TABLE 1<br><br>Examples: 1 2 3 4 5 6 7 — Comparative examples: 1 2 3 4 5 6 7 8 9<br><br>Copper foil: Electrodeposited copper foil<br>Thickness of copper foil [μm]: 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [4b] and tensile strength of 30 to 60 kgf/mm2. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) tensile strength of 30 to 60 kgf/mm2.<br><br>For example:<br><br>“A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm.”<br>*Id*. at Abstract.<br><br>“The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a tensile strength of 30 to 40 kgf/mm2.”<br>*Id*. at claim 4.<br><br>“Preferably, the copper foil has a tensile strength of 30 to 40 kgf/mm2.”<br>*Id*. at [0015].<br><br>“In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, an elongation of 3 to 20%, and a thickness of 1 to 35 μm. Out of the above ranges, the properties of the copper foil are deviated to increase the number of wrinkles, and the properties of the current collector become irregular.<br>[0030]<br>The following table 1 shows measurement results of wrinkle characteristics of the copper foils for a current collector of a lithium secondary battery according to examples 1 to 7 of the present invention |

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| | and comparative examples 1 to 9. In the table 1, the tensile strength was measured by using a UTM (Universal Testing Machine), and at this time the gauge length was set to 5 cm.” *Id*. at [0029]-[0030]. TABLE 1-continued<br>Examples: 1 2 3 4 5 6 7 — Comparative examples: 1 2 3 4 5 6 7 8 9<br>(111) + (200) ratio [%]: 76 62 83 70 72 81 66 64 73 62 83 87 57 80 75 76<br>(111) ratio [%]: 26 31 32 20 35 22 36 16 41 37 19 34 26 30 23 25<br>(200) ratio [%]: 50 31 51 50 36 59 30 48 32 25 64 53 31 49 51 50<br>(220) ratio [%]: 24 38 17 30 29 19 34 36 27 38 17 13 43 21 26 25<br>Tensile strength [kg/mm$^2$]: 32.2 33.7 34.5 32.6 32.1 37.2 33.1 36.8 33.2 31.4 37.1 33.1 32.4 27.4 41.5 31.8<br>Weight deviation [%]: 0.4 0.7 0.8 1.6 0.4 2.6 1.2 0.5 0.9 0.5 0.9 0.7 0.8 0.6 0.9 3.4<br>Number of wrinkles [ea]: 0 0 0 0 0 0 0 2 3 3 4 2 3 2 2 5<br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5pre] A current collector for a | To the extent the preamble of claim 5 is found to be limiting, Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a current collector for a secondary battery. |

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| secondary battery, the current collector comprising: | For example:<br><br>“Copper foil for current collector of lithium secondary battery with improved wrinkle characteristics” *Id*. at TITLE.<br><br>“A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm.” *Id*. at Abstract.<br><br>“A copper foil for a current collector of a lithium secondary battery,<br>2. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a surface roughness (Rz-JIS) of 2 μm or less.<br>3. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a weight deviation of 3% or less.<br>4. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a tensile strength of 30 to 40 kgf/mm2.<br>5. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%.<br>6. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a thickness of 1 to 35 μm.” *Id*. at claims 1, 3, 4, 5, 6.<br><br>“The present invention relates to a copper foil used as a current collector of a lithium secondary battery, and more particularly to a copper foil for a current collector of a lithium secondary battery, which has a structure capable of preventing the generation of wrinkles on a surface of the copper foil.” |

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| | *Id*. at [0003].<br><br>"Battery characteristics of a lithium secondary battery are greatly changed in accordance with a surface state of a copper foil used as a current collector, so it is very important to improve surface characteristics such as wrinkle characteristics in order to improve a yield."<br>*Id*. at [0008].<br><br>"The present invention is designed to solve the problems of the prior art, and therefore it is an object of the present invention to provide a copper foil for a current collector of a lithium secondary battery with a crystal structure capable of decreasing the generation of wrinkles at a surface of the copper foil.<br>[0011]<br>Another object of the present invention is to provide a copper foil for a current collector of a lithium secondary battery, wherein factors such as surface roughness, weight deviation, tensile strength, elongation, and thickness are optimized so as to effectively decrease the generation of wrinkles at a surface of the copper foil.<br>[0012]<br>In one aspect of the present invention, there is provided a copper foil for a current collector of a lithium secondary battery,"<br>*Id*. at [0010]-[0012].<br><br>"The copper foil for a current collector of a lithium secondary battery according to the present invention does substantially not cause the generation of a wrinkle at a surface of the copper foil, so it is possible to form a uniform coating surface and prevent a short circuit when being coated with active material."<br>*Id*. at [0018].<br><br>"FIG. 1 is a photograph showing that a wrinkle is generated at a conventional copper foil for a current collector of a lithium secondary battery; and<br>[0021]<br>FIG. 2 is a graph showing a result of X-ray diffraction (XRD) to calculate a texture coefficient of a copper foil for a current collector of a lithium secondary battery according to the present invention."<br>*Id*. at [0020]-[0021]. |

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| | "A copper foil for a current collector of a lithium secondary battery according to the present invention gives surface characteristics in which factors such as crystal structure, surface roughness, weight deviation, tensile strength and elongation are optimized not to generate a wrinkle.<br>[0024]<br>Preferably, the copper foil for a current collector of a lithium secondary battery according to the present invention is made by adding a small amount of organic additives to a copper sulfate solution containing copper sulfate, sulfuric acid and chlorine."<br>*Id*. at [0023]-[0024].<br><br>"The following table 1 shows measurement results of wrinkle characteristics of the copper foils for a current collector of a lithium secondary battery according to examples 1 to 7 of the present invention and comparative examples 1 to 9. In the table 1, the tensile strength was measured by using a UTM (Universal Testing Machine), and at this time the gauge length was set to 5 cm."<br>*Id*. at [0030].<br><br>"Meanwhile, it would be also found that the copper foils according to the comparative examples 1 to 9 have inappropriate characteristics as a current collector of a lithium secondary battery since a lot of winkles occur.<br>[0032]<br>The copper foil for a current collector of a lithium secondary battery according to the present invention may have an improved wrinkle characteristic in comparison to conventional cases even if it satisfies only the condition of texture coefficient ratio."<br>*Id*. at [0031]-[0032].<br><br>"The copper foil for a current collector of a lithium secondary battery according to the present invention has excellent peel strength since a sufficient adhesive force is ensured when the copper foil is contacted with anode active material such as carbon-based slurry, so it is possible to realize a lithium secondary battery that may stably keep a battery capacity."<br>*Id*. at [0034]. |

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| | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5a] the electrolytic copper foil according to claim 1; and | Kim887 discloses or renders the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5b] a protective layer disposed on the electrolytic copper foil, | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a protective layer disposed on the electrolytic copper foil.<br><br>For example:<br><br>“Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.”<br>*Id*. at [0007].<br><br>“As the process condition, copper is electrodeposited on a drum surface of a foil making machine with a current density of 30 to 80 ASD (A/dm2) at a temperature of 30 to 60° C., and the surface of the copper foil is chromated to prevent corrosion.”<br>*Id*. at [0024]. |

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| | “As the plating conditions to obtain the crystalline structure, copper is electrodeposited onto a drum surface of a foil making machine with a current density of 30 to 80 ASD at a temperature of 30 to 60° C. to make an original foil, and a nodule is formed thereat as necessary. After that, the surface of the copper foil is finally chromated to prevent corrosion.”<br>*Id*. at [0025].<br><br>“At this time, the copper foil is preferably an electrodeposited copper foil that is surface-chromated for the prevention of corrosion.”<br>*Id*. at [0028].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5c] wherein the protective layer comprises at least one of chromate, benzotriazole, and a silane compound. | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) that the protective layer comprises at least one of chromate, benzotriazole, and a silane compound.<br><br>For example:<br><br>*See* disclosures for [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from |

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| | known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The current collector according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil. | Kim887 discloses or renders obvious the copper foil for a current collector of a lithium secondary battery according to claim 1, as set forth above with respect to claim 5.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the copper foil for a current collector of a lithium secondary battery according to claim 5, wherein the protective layer is formed on the first and second surfaces of the electrolytic copper foil.<br><br>For example:<br><br>*See* disclosures for [5b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| [1pre] An electrolytic copper foil, which includes a first surface and a second surface opposite the first | To the extent the preamble of claim 1 is found to be limiting, Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil, which includes a first surface and a second surface opposite the first surface.<br><br>For example: |

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| surface, the electrolytic foil comprising: | “A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil.”<br>*Id*. at [0007].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1a] a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface; | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a matte surface facing the first surface and a shiny surface facing the second surface.<br><br>For example:<br><br>“A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil.”<br>*Id*. at [0007].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from |

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| | known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a first protective layer on the matte surface of the copper layer; and | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer on the matte surface of the copper layer.<br><br>For example:<br><br>*See* disclosures for ’090 patent [5b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’541 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a second protective layer on the shiny surface of the copper layer, | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer on the shiny surface of the copper layer.<br><br>For example:<br><br>*See* disclosures for ’090 patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from |

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| | known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C./min, ranges from 16 to 22 μm/(m-º C.), | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1e] a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2, | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190º C for 1 hour, ranges from 21 to 36 kgf/mm2,<br><br>For example:<br><br>*See* disclosures for ’090 patent [4b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’090 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of |

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| | which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1f] a weight deviation of the electrolytic copper foil is 5% or less, | Kim887 discloses (at least based on SKN's apparent interpretation of the claims) a weight deviation of the electrolytic copper foil is 5% or less.<br><br>For example:<br><br>" A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less,"<br>*Kim887* at Abstract.<br><br>" The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has a weight deviation of 3% or less."<br>*Id*. at claim 3.<br><br>" Preferably, the copper foil has a weight deviation of 3% or less"<br>*Id*. at [0014].<br><br>" The weight deviation of the copper foil should be 3% or less. If the weight deviation exceeds 3%, property deviations occur at the surface of the copper foil, which may increase the number of wrinkles and make properties of the current collector irregular. Here, the weight deviation is obtained by cutting a copper foil by an area of 5 cm×5 cm to make a test piece, measuring weight of the test piece and converting the weight into a weight of the copper foil per a unit area, cutting the test piece along a width direction of the copper foil, repeating the above processes to measure weights of copper foils of every test piece, and then calculating a standard deviation."<br>*Id*. at [0028]. |

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| | TABLE 1-continued<br><br>Examples: 1 2 3 4 5 6 7 — Comparative examples: 1 2 3 4 5 6 7 8 9<br><br>(111) + (200) ratio [%]: 76 62 83 70 72 81 66 — 64 73 62 83 87 57 80 75 76<br>(111) ratio [%]: 26 31 32 20 35 22 36 — 16 41 37 19 34 26 30 23 25<br>(200) ratio [%]: 50 31 51 50 36 59 30 — 48 32 25 64 53 31 49 51 50<br>(220) ratio [%]: 24 38 17 30 29 19 34 — 36 27 38 17 13 43 21 26 25<br>Tensile strength [kg/mm$^2$]: 32.2 33.7 34.5 32.6 32.1 37.2 33.1 — 36.8 33.2 31.4 37.1 33.1 32.4 27.4 41.5 31.8<br>Weight deviation [%]: 0.4 0.7 0.8 1.6 0.4 2.6 1.2 — 0.5 0.9 0.5 0.9 0.7 0.8 0.6 0.9 3.4<br>Number of wrinkles [ea]: 0 0 0 0 0 0 0 — 2 3 3 4 2 3 2 2 5<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1g] a peak count (Pc) of each of the first and second surfaces of the electrolytic copper | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The |

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| foil ranges from 3 to 92, and | motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1h] each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less. | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) that each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less.<br><br>For example:<br><br>*See* disclosures for ’090 patent [Claim 3].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) an elongation of 3% or more at room temperature.<br><br>For example:<br><br>“ crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm.” |

| **’689 Patent** | **Kim887** |
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| | *Kim887* at Abstract.<br><br>“ The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein the copper foil has an elongation of 3 to 20%.”<br>*Id*. at claim 5.<br><br>“ Preferably, the copper foil has an elongation of 3 to 20%.”<br>*Id*. at [0016].<br><br>“ In addition, the copper foil should satisfy the following conditions: a tensile strength of 30 to 40 kgf/mm2, an elongation of 3 to 20%, and a thickness of 1 to 35 μm.”<br>*Id*. at [0029].<br><br>To the extent the limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound.<br><br>For example:<br><br>*See* disclosures for ’090 Patent [5b]. |

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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.<br><br>For example:<br><br>*See* disclosures for ’090 Patent [4].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion | To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’689 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover |

| ’689 Patent | Kim887 |
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| of 17.3 to 22 μm/(m-º C.). | Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’706 Patent | Kim887 |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, wherein: | To the extent the preamble of claim 1 is found to be limiting, Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>“A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil.”<br>*Kim887* at [0007].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

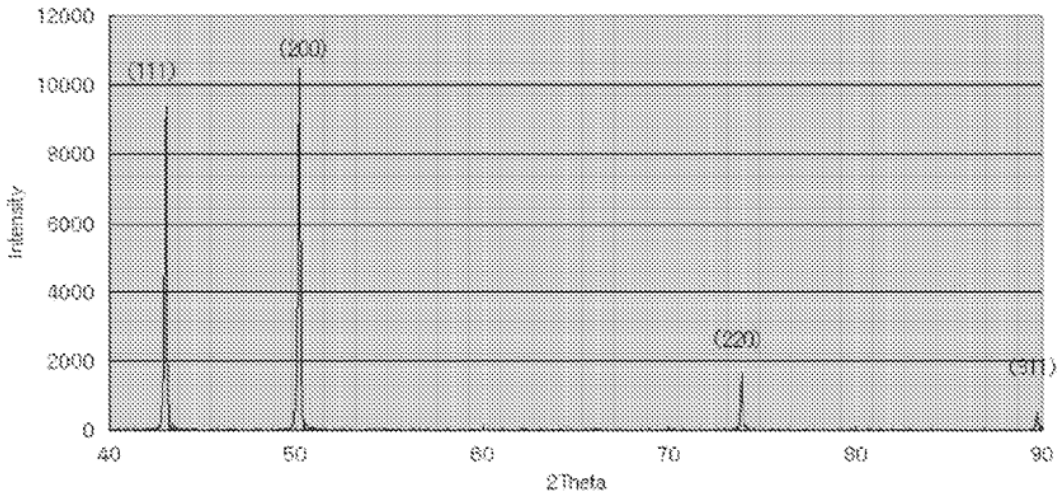
| **'706 Patent** | **Kim887** |
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| [1a] a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl))) | Kim887 discloses (at least based on SKN's apparent interpretation of the claims) a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br><br>The specification 4:1-2 describes considered planes are (111), (200), (220), (311)]<br>[Specification 3-4 describes use of JCPDS standards for standard copper power. Also describes "the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees"<br><br>Kim887 provides the planes that are (111), (200), (220), (311).<br><br>For example:<br><br>"A copper foil for a current collector of a lithium secondary battery has a crystalline structure, in which a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%. The copper foil has surface roughness (Rz-JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40 kgf/mm2, elongation of 3 to 20%, and thickness of 1 to 35 μm."<br>*Kim887* at Abstract.<br>"A copper foil for a current collector of a lithium secondary battery,<br>wherein, in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface to a total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of a texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 28 to 62%, and a ratio of the texture coefficient of the (220) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 15 to 40%, and<br>wherein the texture coefficient satisfies the following equation: |

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| | $$TC(hkl) \geq \frac{\frac{I(hkl)}{I_0(hkl)}}{\frac{1}{n}\Sigma\frac{I(hkl)}{I_0(hkl)}}$$<br>*Id*. at claim 1.<br><br>“In one aspect of the present invention, there is provided a copper foil for a current collector of a lithium secondary battery, wherein, in a crystalline structure, a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and a (220) surface is 60 to 85%, a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface is 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%.”<br>*Id*. at [0012].<br><br>“A crystalline structure of the copper foil should satisfies a condition that a ratio of the sum of texture coefficients of the (111) surface and the (200) surface, to the total sum of texture coefficients of the (111) surface, the (200) surface and the (220) surface, is 60 to 85%. Also, a ratio of the texture coefficient of the (111) surface to the total sum of the texture coefficients of the (111) surface, the (200) surface and the (220) surface should be 18 to 38%, a ratio of the texture coefficient of the (200) surface thereto should be 28 to 62%, and a ratio of the texture coefficient of the (220) surface thereto should be 15 to 40%”<br>*Id*. at [0025]. |

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TABLE 1-continued

| | Examples | | | | | | | Comparative examples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| (111) + (200) ratio [%] | 76 | 62 | 83 | 70 | 72 | 81 | 66 | 64 | 73 | 62 | 83 | 87 | 57 | 80 | 75 | 76 |
| (111) ratio [%] | 26 | 31 | 32 | 20 | 35 | 22 | 36 | 16 | 41 | 37 | 19 | 34 | 26 | 30 | 23 | 25 |
| (200) ratio [%] | 50 | 31 | 51 | 50 | 36 | 59 | 30 | 48 | 32 | 25 | 64 | 53 | 31 | 49 | 51 | 50 |
| (220) ratio [%] | 24 | 38 | 17 | 30 | 29 | 19 | 34 | 36 | 27 | 38 | 17 | 13 | 43 | 21 | 26 | 25 |
| Tensile strength [kg/mm$^2$] | 32.2 | 33.7 | 34.5 | 32.6 | 32.1 | 37.2 | 33.1 | 36.8 | 33.2 | 31.4 | 37.1 | 33.1 | 32.4 | 27.4 | 41.5 | 31.8 |
| Weight deviation [%] | 0.4 | 0.7 | 0.8 | 1.6 | 0.4 | 2.6 | 1.2 | 0.5 | 0.9 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.9 | 3.4 |
| Number of wrinkles [ea] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 4 | 2 | 3 | 2 | 2 | 5 |

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| | FIG. 2<br>  <br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a difference (\|Δ(Rz/Ra)\|) between Rz/Ra at the first surface of the | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a difference (\|Δ(Rz/Ra)\|) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42. |

| **'706 Patent** | **Kim887** |
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| electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and | For example:<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1c] a difference (\|ΔPD\|) between a peak density (PD) at the first surface of the electrolytic copper foil and a peak density (PD) at the second surface of the electrolytic copper foil is 96 ea or less. | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the '706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN's apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the second surface is an M surface, and Rz/Ra at the second surface is 4.2 to 9.0.<br><br>For example: |

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| | “ A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.”<br>*Kim887* at [0007].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 3] The electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 2, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 2, wherein the first surface is an S surface, and Rz/Ra at the S surface of the electrolytic copper foil is 5.1 to 6.8.<br><br>For example:<br>“ A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil. Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance and color fastness.”<br>*Kim887* at [0007]. |

| ’706 Patent | Kim887 |
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| | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a tensile strength, measured at room temperature, of 30 to 65 kgf/mm2.<br><br>For example:<br><br>*See* disclosures for ’090 Patent [4b].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 5] The electrolytic copper foil according to claim 1, | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1. |

| ’706 Patent | Kim887 |
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| wherein the electrolytic copper foil has an elongation, measured at room temperature, of 3% or more. | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has an elongation measured at room temperature, of 3% or more.<br><br>For example:<br><br>*See* disclosures for ’689 [Claim 2].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 6] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a lateral weight deviation of 5% or less.<br><br>For example:<br>*See* disclosures for ’689 [1f].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’706 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the |

| ’706 Patent | Kim887 |
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| | person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Kim887 |
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| [1pre] An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising: | To the extent the preamble of claim 1 is found to be limiting, Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) an electrolytic copper foil having a first surface and a second surface.<br><br>For example:<br><br>> “A so-called shiny side is formed on one surface of the electrodeposited copper foil by means of electroplating in accordance with a surface shape of a drum of a foil making machine, and a matte side having a relatively high surface roughness due to a mountain structure is formed on the other side of the electrodeposited copper foil.”<br>*Kim887* at [0007].<br><br>To the extent that this preamble is limiting and is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| **’014 Patent** | **Kim887** |
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| [1a] a first protective layer at the first surface; | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a first protective layer at the first surface.<br><br>For example:<br><br>*See* disclosures for ’090 patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1b] a second protective layer at the second surface; and | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a second protective layer at the second surface; and<br><br>For example:<br><br>*See* disclosures for ’090 patent [5b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

| ’014 Patent | Kim887 |
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| [1c] a copper film disposed between the first and second protective layers, wherein | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a copper film disposed between the first and second protective layers.<br><br>For example:<br><br>*See* disclosures for *Kim887* [1pre]<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [1d] binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) a binding coefficient of the electrolytic copper foil at the first surface or the second surface, defined as Mathematical Expression 1 below, is 1.5 to 9.4, (Mathematical Expression 1) Binding coefficient = Rp/μm + peak density/30 + amount of attachment of Cr/(mg/m^2) (wherein the Rp (μm) is a peak height measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer).<br><br>For example:<br><br>*See* disclosures for ’090 Patent [Claim 3], [5b]. |

| ’014 Patent | Kim887 |
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| measured according to JIS B 0601 (2001) standard, wherein the peak density is a number of peaks per unit length of 4 mm, wherein the peak density is measured according to ASME B46.1 (2009) standard with a peak count level of +/- 0.5 μm and wherein the amount of attachment of Cr (mg/m^2) is measured by dissolving the first surface or the second surface of the electrolytic copper foil (110) with a nitric acid solution to obtain a dissolved solution, diluting the dissolved solution with water to obtain a diluted solution, and analyzing the diluted solution using an atomic absorption spectrometer). | To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |
| [Claim 2] The electrolytic copper foil | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1. |

| ’014 Patent | Kim887 |
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| according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br>wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number | Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein an X-ray diffraction pattern of the copper film measured at the first surface or the second surface shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28,<br>TC(220)= ((I(220))/(I_0 (220)))/(1/n ∑(I(hkl))/(I_0 (hkl)))<br>wherein TC (220) is the texture coefficient of the (220) plane, wherein I(hkl) is XRD diffraction strength of (hkl) crystal plane of the electrolytic copper foil, I0 (hkl) is XRD diffraction strength of (hkl) crystal plane of standard copper powder prescribed by Joint Committee on Power Diffraction Standards (JCPDS), wherein n is a number of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes.<br><br>For example:<br><br>*See* disclosures for ’706 [1a].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by Kim887, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |

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| of diffraction peaks within 30° to 95° of diffraction angles (2 P), and wherein the (hkl) crystal plane includes (111), (200), (220), and (311) crystal planes, | |
| [Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature. | Kim887 discloses or renders obvious the electrolytic copper foil according to claim 1, as set forth above with respect to claim 1.<br><br>Kim887 discloses (at least based on SKN’s apparent interpretation of the claims) the electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm2 measured at normal temperature.<br><br>For example:<br><br>*See* disclosures for ’090 patent [4b].<br><br>To the extent that this limitation is not disclosed, either explicitly or inherently, by *Suzuki, Ch. 10*, this limitation is obvious in combination with the knowledge of one of skill in the art and/or it would have been obvious to one of skill in the art at the time of the ’014 patent to combine this reference with any of the other references in Appendix A as charted for this claim limitation and which are discussed in the Cover Pleading. The motivations to combine may come from the knowledge of the person of ordinary skill themselves, or from known problems and predictable solutions as embodied in these references, examples of which are discussed in the Cover Pleading, other references in Appendix A as well as the references in Appendix B. |