APPENDIX B – Secondary References

This chart details certain exemplary teachings from prior art that serves as secondary references for each of the limitations for which those references are cited. To the extent any limitation is not taught by any of the references in Appendix A, a person of skill in the art would turn have been motivated to modify it to include that limitation for the reasons discussed in the Cover Pleading (which is incorporated by reference) and discussed further below. Further, as described below, each of the claimed features was well known in the art as demonstrated by multiple references. Therefore, a POSITA would have been motivated to supplement each of the prior art references with the teachings described herein (either alone or in combination with other references) as the benefits of doing so were well known and the implementation would be nothing more than implementing a known technique in a similar device.

This chart contains teachings from the following references:

Reference	Short Name	Date	Bates
"Measuring Copper Surface Roughness for High Speed Applications"	Marshall	2007	PRIOR_ART-00001538
"Mechanical Size Effects in Thin Copper Foils "	Simons	1975	PRIOR_ART-00000306
"Temperature Dependent Elastic and Thermal Properties of Thin Foils"	Khatibi	2007	PRIOR_ART-00001393
ASME B46.1-2009 ("Surface Texture (Surface Roughness, Waviness, and Lay")	ASME B46.1-2009	2009	SKN-0006603
Assessment of activated polyacrylamide and guar as organic additives in copper deposition	Fabian	December 19, 2006	PRIOR_ART-00000326
Changes in the Tensile Strength and Fracture Mode with Thickness of Electrodeposited Copper Foil	Yang	1997	PRIOR_ART-00000148
Characterization of Electrodeposited Copper Foil Surface Roughness for Accurate Conductor Power Loss Modeling	Griesi	December 15, 2014	PRIOR_ART-00000351
Elastic and Elastoplastic Response of Thin Copper Foil	Merchant	March 12, 2003	PRIOR_ART-00001561

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Reference	Short Name	Date	Bates
Electroforming –A Literature Review and a New Application	Safranek	January, 1948	PRIOR_ART-00001709
EP0851944 ("Method for producing electrodeposited copper foil and copper foil obtained by the same")	Otsuka 944	April 14, 1999	PRIOR_ART-00001631
EP3663438A1 ("Anti-creasing copper foil, electrode comprising same, secondary battery comprising same, and manufacturing method therefor")	Hua	June 10, 2020	PRIOR_ART-00000276
Fatigue and Fracture Properties of Thin Metallic Foils	Hadrboletz	August 9, 2000	PRIOR_ART-00000440
Formulation of Chromate Conversion Coatings on Aluminum and its Alloys: An In Situ XANES Study	Sasaki	2005	PRIOR_ART-00002601
Gadelmawla, Roughness parameters, Journals of Materials Processing Technology 123 (2002) 133-145	Gadelmawla	January 14, 2002	PRIOR_ART-00000338
Geometrical Production Specifics (DIN EN ISO 4287:2010-07)	DIN EN ISO 4287:2010-07	July 2010	PRIOR_ART-00002398
HALLE Praziosions-Kalibriernormal GmbH Technical Document on Calibration Standards for Contact-Style Instruments	HALLE Technical Document	May 12, 2009	PRIOR_ART-00000462
High Strength, Low Profile Copper Foil for High Performance PCBs, Circuit World Vol. 21 No. 3	Chiang	1995	PRIOR_ART-00000162
Japanese Industrial Standard (JIS) B 0601-1994	JIS B 0601 – 1994	1994	PRIOR_ART-00001256

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Reference	Short Name	Date	Bates
Japanese Industrial Standard (JIS) B 0601-2001	JIS B 0601 – 2001	2001	SKN-0006729
JP2003051340 ("Lithium secondary battery")	Hara	February 21, 2003	PRIOR_ART-00000470 (translation)
Kobelco, the ABCs of Arc Welding Web Page	Kobelco	2014	PRIOR_ART-00002610
KR 2012/0003485A ("Method for protecting information on near field communication and apparatus using the method")	Toshio	January 10, 2012	PRIOR_ART-00002083; PRIOR_ART-00002138 (translation)
KR 2017-0053888 ("Electrolytic Copper Foil, Electrode Comprising The Same, Secondary Battery Comprising The Same, and Method for Manufacturing The Same")	Seung	May 17, 2017	PRIOR_ART-00001741
KR20070094123A		September 20, 2007	PRIOR_ART-00001451
KR20170000761 ("Electrolytic copper foil, current collector comprising the same, electrode comprising the same, secondary battery comprising the same, and method for manufacturing the same")	Kim	January 3, 2017	PRIOR_ART-00001417; PRIOR_ART-00001401 (translation)
Laser and Optics User's Manual (2002), Agilent Technologies (2002)	Laser and Optics User's Manual	July, 2002	PRIOR_ART-00002386
Microstructural Development During Fatigue of Copper Foils 20-100 μm thick	Judelewicz	November 5, 1993	PRIOR_ART-00001366

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Reference	Short Name	Date	Bates
Operating Instructions MarSurf M 300 + RD 18, Mahr GmbH, 2008	MarSurf M300 instruction manual	2008	SKN-0006850
Physical Properties of Electrodeposited Metals	Zentner	August, 1952	PRIOR_ART-00001649
Suzuki, "Copper Foil Smooth on Boat Sides for Lithium-Ion Battery*" Copper Electrodeposition for Nanofabrication of Electronics Devices*, Chapter 10	Suzuki	2014	PRIOR_ART-00001777
Tensile Strength of Electrolytic Copper on a Rotating Cathode, C.W. Bennett	Bennett	April 20, 1912	PRIOR_ART-00000126
U.S. 2016/0260980 ("Electrolytic Copper Foil, Electric Component and Battery Including the Same")	Lee 980	September 8, 2016	PRIOR_ART-00001493
U.S. Patent No. 4,695,348 ("Copper Etching Process and Product")	Battey	September 22, 1987	PRIOR_ART-00000121
U.S. Patent No. 5,326,455 ("Method of producing electrolytic copper foil and apparatus for producing same")	Kubo	July 5, 1994	PRIOR_ART-00001459
U.S. Patent No. 5,834,140 ("Electrodeposited copper foil for fine pattern and method for producing the same")	Wolski	November 10, 1998	PRIOR_ART-00002283
U.S. Patent No. 6,153,077 ("Process for preparing porous electrolytic metal foil")	Kato	November 28, 2000	PRIOR_ART-00001374
U.S. Patent No. 6,451,441 ("Film with Metal Foil")	Nishimoto	September 17, 2020	PRIOR_ART-00001595

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Reference	Short Name	Date	Bates
U.S. Patent No. 8,715,836 ("Surface-treated electro-deposited copper foil and method for manufacturing the same")	Dobashi	May 6, 2014	PRIOR_ART-00000174
U.S. Patent No. 9,209,485 ("Electrolytic Copper foil")	Cheng	December 8, 2015	PRIOR_ART-00000155
U.S. Patent No. 9,293,771 ("Anode for secondary battery, anode current collector, production method thereof, and secondary battery")	Tani	March 22, 2016	PRIOR_ART-00002057
U.S. Patent No. 9,365,942 ("Electrolytic copper foil and method for producing the same")	Tsai	June 14, 2016	PRIOR_ART-00002255
U.S. Patent No. 9,457,541 ("Copper Foil For Current Collector of Lithium Secondary Battery with Improved Wrinkle Characteristics")	'541 Patent	October 4, 2016	PRIOR_ART-00001434
U.S. Patent No. 9,711,799 ("Copper foil having uniform thickness and methods for manufacturing the copper foil")	Lai	July 18, 2017	PRIOR_ART-00001479
U.S. Pub. 2004/0029006A1 ("Electrodeposited copper foil and electrodeposited copper foil for secondary battery collector")	Otsuka 006	February 12, 2004	PRIOR_ART-00001642
U.S. Pub. 2006/0191798 ("Electrolytic copper foil with low roughness surface and process for producing the same")	Sano	August 31, 2006	PRIOR_ART-00001729
U.S. Pub. 2007/0287020 ("Surface treated electrodeposited copper foil, the production method and circuit board")	Saito	December 13, 2007	PRIOR_ART-00001720

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Reference	Short Name	Date	Bates
U.S. Pub. 2008/0050652 ("Negative Electrode and Secondary Cell")	Hirose 2008	January 13, 2009	PRIOR_ART-00000478
U.S. Pub. 2008/0176144 ("Electrode current collector and method for inspecting the same, electrode for battery and method for producing the same, and secondary battery and method for producing the same")	Iwama	January 17, 2012	PRIOR_ART-00001230
U.S. Pub. 2009/0061326 ("Current Collector, Anode, and Battery")	Hirose 2009	March 5, 2009	PRIOR_ART-00000505
U.S. Pub. 2010/0038115 ("Electrodeposited Copper Foil, Its Manufacturing Method, Surface-treated Electrodeposited Copper Foil Using The Electrodeposited Copper Foil, and Copper-clad Laminate and Printed Wiring Board Using The Surface-treated Electrodeposited Copper Foil")	Matsuda	February 18, 2010	PRIOR_ART-00001544
U.S. Pub. 2010/0136434 ("Electrolytic Copper Foil for Lithium Rechargeable Battery and Process for Producing the Copper Foil")	Hanafusa	June 3, 2010	PRIOR_ART-00000463
U.S. Pub. 2013/0071755 ("Surface treatment method for copper foil, surface-treated copper foil, and copper foil for negative electrode collector of lithium ion secondary battery")	Oguro	March 21, 2013	PRIOR_ART-00001606

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Reference	Short Name	Date	Bates
U.S. Pub. 2013/0108887 ("Copper Foil For Current Collector of Lithium Secondary Battery with Improved Wrinkle Characteristics")	Kim 887 (A12)	May 2, 2013	PRIOR_ART-00001429
U.S. Pub. 2013/0108922 ("Electrolytic copper foil, electrolytic copper foil for lithium ion secondary battery, electrode for lithium ion secondary battery using the electrolytic copper foil, and lithium ion secondary battery using the electrode")	Shinozaki	May 2, 2013	PRIOR_ART-00001756
U.S. Pub. 2013/0256140 ("Electrolytic copper foil")	Kohiki	October 3, 2013	PRIOR_ART-00001440
2014/0291156A1 ("High Strength, High Heat Resistance Electrodeposited Copper Foil and Manufacturing Method for Same")	Ezura	October 2, 2014	PRIOR_ART-00000311
U.S. Pub. 2014/0302281 ("Embossed polymer sheet")	Yacovone	October 9, 2014	PRIOR_ART-00002292
U.S. Pub. 2015/0030873 ("Electrolytic Copper foil")	Cheng Appl.	January 29, 2015	PRIOR_ART-00002211
U.S. Pub. 2015/0267313 ("Electrodeposited copper foil")	Chou	September 24, 2015	PRIOR_ART-00000166
U.S. Pub. 2017/0141404 ("Electrolytic copper foil, and collector, negative electrode, and lithium battery comprising same")	Song	May 18, 2017	PRIOR_ART-00001767

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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.

The excerpts cited herein are exemplary. For any claim limitation, Defendant may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein to the extent necessary to provide a more comprehensive explanation for a reference's disclosure of a limitation. 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.

U.S. 9,457,541 Secondary References

'541 Patent	Prior Art Disclosures
1[pre]. A copper foil for a current collector of a lithium secondary battery,	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. For example, a POSITA would have found it obvious to modify each primary reference to use its copper foil for a current collector because it was well-known that copper foils were well-suited to use as a current collector in a lithium secondary battery due to their electrical properties and mechanical properties that would permit them to withstand conventional battery manufacturing processes as well as the cycling between battery charged and discharged states. Further, for references directed to copper foils for PCBs, a POSITA would have found it obvious to use or try the copper foil as a current collector for a secondary battery at least because it was well known that copper foils in PCBs could also be used in secondary batteries and were suitable for that purpose. *See, e.g.*, Wolski, PRIOR_ART-00002283. The references in Appendix A, such as for example, Hirose 2009 (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), Otsuka 006 (A16), Sano (A18), Kim 887 (A12) (A12), Kim 761 (A11), Hara (A6), and Hanafusa (A5) (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. Indeed, the '541 Patent acknowledges in its description of the: "Background of The Invention" and "Related Art" that "[a] lithium secondary battery has many advantages such as high energy density, high operation voltage, excellent preservation and excellent life cycle in

'541 Patent	Prior Art Disclosures
	comparison to other kinds of secondary batteries, so the lithium secondary battery is widely used for various portable electronic devices such as personal computers, camcorders, cellular phones, portable CD players and PDA. '541 Patent, PRIOR_ART-00001434, at 1:24-30. Further, it acknowledges that "[i]n the lithium secondary battery, a copper foil is mostly used as material of the anode current collector." *Id.* at 1:38-39. It further describes "conventional" copper foils. *Id.* at 2:44-46, 5:25-30. *See also, e.g.*, *id.* at 1:16-32, 5:25-30. **Wolski** Wolski is directed to electrodeposited copper foil manufactured using an electrolytic drum and applying a roughness treatment used for both printed circuit boards (PCBs) and secondary batteries: The present invention is an electrodeposited copper foil characterised in that roughening treatment is performed on a matte Side of an untreated copper foil wherein the Surface roughness R of the matte side of the untreated copper foil is the same as or less than the Surface roughness R of the Shiny Side of this untreated copper foil. The electrodeposited copper foil is made by electrodepositing copper onto a drum from an electrolyte which contains 0.05 to 5 ppm 3-mercapto 1-propanesulfonate, at least one organic compound Selected from 0.1 to 15 ppm of a polysaccharide which is a carbohydrate Such as Starches, celluloses and vegetable rubbers, and 0.3 to 35 ppm of a low molecular weight glue having a weight average molecular weight of 10,000 or less; and 10 to 60 ppm of a chloride ion. The copper foil may be used in making a printed circuit board or as a component of a Secondary battery cell. Wolski, PRIOR_ART-00002283 at Abstract.

'541 Patent	Prior Art Disclosures
	See also: The present invention relates to an electrodeposited copper foil which is capable of making a fine pattern and capable of obtaining a high etching factor, a method for producing the Same, and a copper-clad laminated board and a printed-wiring board (printed circuit) using the same. Also, the untreated copper foil according to the present invention has flatter Surfaces on both Surfaces as compared with the conventional ones So that it can be used as an electrode material for a Secondary battery, a flat cable, a Shielding material for covering cables and others, but use of the electrodeposited copper foil of the present invention is not limited thereto. Wolski, PRIOR_ART-00002283 at 1:5-18 ("Field of Invention") A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[a] wherein, in a crystalline structure, a ratio of a sum of texture coefficients of a (111) surface and a (200) surface	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in

'541 Patent	Prior Art Disclosures
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,	light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have known that texture coefficients (which characterize the crystal structure) of copper foil and thus, the relative abundance or scarcity of these crystal planes, affect the suitability of a copper foil in a copper foil in a battery. For example, it was known that the texture coefficients affect adhesion between the copper foil and the active material and, consequently, the battery's charge/discharge cycle life. Further, a POSITA would have known that the disclosed texture coefficient results in a preferred crystalline structure orientation. As the '541 Patent File History explains: > Hirose discloses a copper foil (¶ 145) used in lithium battery current collectors (¶ 3-4). Hirose teaches that an ideal ratio between the (200) and (111) planes should be between 0.5 and 1.5 (¶ 12) in order to improve the contact characteristics and cycle characteristics of a battery (¶ 15). Hirose also teaches the (220) plane should not be a primary orientation (¶ 155, see Figs. 11A and 11B). Hirose therefore recognizes that these crystal planes are important characteristics for a copper foil in a battery, and thus, the relative abundance or scarcity of these crystal planes, and by corollary, any measure of the intensity of these planes in the copper foil, are result effective variables . . . One of ordinary skill in the art therefore would have been motivated, based on the teachings of Hirose, to obtain the ideal amounts of these crystal planes in a copper foil through routine optimization and thereby also arrive at the claimed ratios of texture coefficients (i.e., a ratio of crystal planes). '541 Patent File History, SKN-0001767 at SKN-0002320 (Office Action). In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at 563 (Applicant-Initiated Interview Summary). One of ordinary skill in the art therefore would have been motivated to arrive at a copper foil practicing this limitation through routine optimization and experimentation.

'541 Patent	Prior Art Disclosures
	A POSITA would have had a reasonable expectation of success in modifying the primary reference to disclose this limitation. For example, it was known that texture coefficients can be manipulated by varying electrolysis conditions, chemistry, and manufacturing processes (*e.g.*, rolling and heating techniques). Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of texture coefficient. The references in Appendix A, such as for example, Sano (A18), Hirose 2009 (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), and Otsuka 006 (A16) (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Yang** Yang, which is directed to electrolytic copper foils, shows that a POSITA would understand that there is a relationship between the orientation of the grains and the electrolysis conditions. Thus, a POSITA would be motivated to evaluate the orientation: > Electrodeposits are known to have fine and randomly oriented grains in an initial stage and to assume their peculiar textures according to electrolysis conditions. Yang, PRIOR_ART-00000148 at PRIOR_ART-00000150. **Battey** Battey, which directed to copper etching and printed circuit boards, (US Patent 4,695,348) renders this limitation obvious. As the '541 Patent File History explains:

'541 Patent	Prior Art Disclosures
	Battey teaches a copper foil used in the manufacture of electronic circuit boards (col. 1, lines 8-17). The crystal orientation of the copper foil is described as being predominantly in the (111) and (200) orientations with relatively little (220) orientation in order to improve etching (col. 2, lines 1-10). Battey gives several examples of copper foils and X-ray diffraction analysis of the crystal structure, concluding that at least 70% of the orientation should be in the (111) and (200) planes, with no more than 15% in the (220) planes (col. 4, lines 1-35). Battey therefore recognizes that these crystal planes are important characteristics for a copper foil, and thus, the relative abundance or scarcity of these crystal planes, and by corollary, any measure of the intensity of these planes in the copper foil, are result effective variables. . . . One of ordinary skill in the art therefore would have been motivated, based on the teachings of Battey, to obtain the ideal amounts of these crystal planes in a copper foil through routine optimization and thereby arrive at the claimed ratios of texture coefficients (i.e., a ratio of crystal planes). '541 Patent File History, SKN-0001767 at SKN-0002321-322 (Office Action). In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at -329 (Applicant-Initiated Interview Summary). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to

'541 Patent	Prior Art Disclosures
	combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[b] wherein the copper foil has a weight deviation of 3% or less, and	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have a uniform copper foil that did not vary in weight, and thus had a weight deviation of 3% or less, to ensure consistent mechanical and electrical properties of the copper foil, improve the manufacturing and yield and meet market demand for uniform copper foils. Further, weight deviations of 3% or less were the obvious and typical result of conventional electrolytic copper foil manufacturing processes. *See, e.g.*, Bennett, PRIOR_ART-00000126 at PRIOR_ART-00000128 (1912 paper disclosing electrolytic copper foil deposition wherein "thickness of deposit is uniform"). A POSITA would have known that uniformity prevents problems with the copper foil. *See, e.g.*, Hara, PRIOR_ART-00000470 at [0007] ("Variations [in thickness] may occur, electrode reactions may become non-uniform, leading to early life, and the concentration of current may cause heat generation, which may impair the safety of the battery. Therefore, it is important to produce a uniform and smooth electrode"); [0009] (" Further, when charging and discharging are repeated, the negative electrode mixture layer repeatedly expands and contracts, and thus the adhesion strength between the negative electrode current collector and the negative electrode mixture layer becomes uneven due to the difference in surface roughness of the negative electrode current collector.") Additionally, a POSITA would have arrived at a weight deviation of 3% or less through conventional electrolytic copper foil manufacturing processes or routine modifications of the same. Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of weight deviation. The references in Appendix A, such as for example, Dobashi (A3), Sano (A18) and Hara (A6) (which have been separately charted and are incorporated by reference herein), as

'541 Patent	Prior Art Disclosures
	well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **KR20070094123A** This limitation is obvious in light of KR20070094123A, which is directed to manufacturing electrolytic metal sheets using a cathode drum: > However, when the distribution or current density of the electrolyte supplied between the cathode drum and the anode electrode is uneven, the produced electrolytic copper foil has an uneven weight variation in the wide direction, and the weight deviation of the electrolytic copper foil leads to poor PCB manufacturing resulting in PCB. **It acts as a factor to significantly reduce the production yield of**. PRIOR_ART-00001451 (emphasis added) A POSITA would also have a reasonable likelihood of success making a copper foil using a drum, as similarly utilized in KR20070094123A. *See* '541 Patent, PRIOR_ART-00001434 at 3:8-22 (describing how the copper foil is electrodeposited on a drum surface of a foil making machine). **Kubo** This limitation is obvious in light of Kubo (U.S. 5,326,455) which is directed to electrolytic copper foils. *See, e.g.*, Kubo, PRIOR_ART-00001459 at Title, Abstract. Kubo discloses, for example: > Nevertheless, there has recently been strong demand for electrolytic copper foils of uniform thickness throughout. Copper foils are used chiefly for the fabrication of printed circuit boards, and the tendency toward finer circuits to

'541 Patent	Prior Art Disclosures
	be formed requires uniform etching of the copper foil and for the purpose a copper foil of uniform thickness is strongly necessitated. For the stabilization of its electric characteristics too, the copper foil must have far less variation in thickness than heretofore. Kubo, PRIOR_ART-00001459 at 2:37-46. In this manner the variations in thickness of the cop per foil produced can be controlled within 1% of the target level. *Id.* at 9:47-49. With the embodiment being described, the thickness of the electrolytic copper foil being produced can be controlled by individually controlling the quantities of electricity supplied to the sub-anodes on the basis of a combination of the patterns of foil thicknesses in both directions of the length and width. *Id.* at 9:50-55. ADVANTAGE OF THE INVENTION The thickness of copper foil is now successfully made uniform, for the first time in the art, by far the greater degree than heretofore, with thickness variations reduced strikingly from the usual level, to less than about a tenth of the usual level in the direction of the width and to less than about a fourth of the usual level in the direction of the length, by individually controlling, during the operation, the quantities of electricity being supplied into a plurality of foil thickness-uniformizing sub-anodes divided widthwise. The foil product obtained is promising as a copper foil required for future electronic devices or the like.

'541 Patent	Prior Art Disclosures
	Id. at 10:39-51. *See also, e.g.*, *Id.* at Abstract, 2:37-39 ("Nevertheless, there has recently been strong demand for electrolytic copper foils of uniform thickness throughout"), 3:13-4:48, 4:41-44 ("According to this invention, the variations in thickness of the copper foil produced are controlled to a strikingly low level of 1% or less, even on the order of no more than 0.5%, on the basis of the target thickness."), 7:27-10:51. **Bennett** Bennett, which is directed at electrolytic copper foils, renders this limitation obvious. Bennett, in 1912, provides five reasons for using a rotating cathode drum, including that the "thickness of deposit is uniform." Bennett PRIOR_ART-00000126 at PRIOR_ART-00000128. > As early as 1865, it was noticed that during electrolysis, if the cathode were rotated at a higher current density could be used. Among those actually making use of this was Wilde, who patented a process in 1875, using for cathode a vertical iron cylinder which was rotated. *Id.* at PRIOR_ART-00000126. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at

'541 Patent	Prior Art Disclosures
	least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[c] wherein the copper foil has a tensile strength of 30 to 40 kgf/mm^2,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have had motivation to manufacture a copper foil with a tensile strength of 30 – 40 kgf/mm2 because copper foils having tensile strengths within this range were commonly used in battery applications and were desirable to ensure that the copper foil could withstand battery manufacturing (e.g., rolling and winding processes) and use (e.g., charge/discharge). At the same time, a POSITA would have been motivated to use a tensile strength beneath 40 kgf/mm2 to ensure that the copper foil can sufficiently deform along with the active material coating it during battery manufacturing and use, and maintain its adhesion to the active material, in order to achieve an enhancement of the charge-discharge property of a secondary battery. *See, e.g.*, Otsuka 006, PRIOR_ART-00001642 at [0011], [0020], [0048]. A POSITA would have arrived at a tensile strength within this range through routine experimentation and optimization. Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of tensile strength. A POSITA could have manufactured a copper foil having a tensile strength of 30 – 40 kgf/mm2 with a reasonable expectation of success using conventional manufacturing techniques and/or routine experimentation. For example, a POSITA would have known that the tensile strength can be varied by varying the chemistry, crystal size, electrodeposition characteristics (e.g., drum material, size, rotational speed, anode material, voltage, heat treatment, etc.), and by performing a heat treatment on the copper foil. Indeed, copper foils having a tensile strength within this range have been commercially produced since the 1900s and were common in battery copper foils as evidenced by other references cited herein. *See, e.g.*, Bennett, PRIOR_ART-00000126 (discussed below); Otsuka 006, PRIOR_ART-00001642 at [0015] (This limitation is also obvious in light of Otsuka, which discloses that a tensile strength of "not more than 40

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	kg/mm2" is desirable because copper foils having " tensile strengths of over 50 kg/mm2 [] are extremely hard. In general, in a copper foil comprised of fine crystals with an average particle size of the crystal structure of several tenths of a micron and having an 10-point average roughness Rz of not more than 2.5 μm, the ordinary temperature tensile strength becomes extremely high and a hard foil results. Since the copper foil is hard, the copper foil does not sufficiently deform along with the active material surface in the rolling or other press flattening step performed after coating the active material, contact with the active material becomes poor, and deterioration of the capacity and a drop in the charge/discharge cycle life are caused. Note that in general the fact that the tensile strength and hardness are in a proportional relationship is known.") The references in Appendix A, such as for example, Sano (A18), Hara (A6), Hanafusa (A5), Hirose 2009 (A7), Kato (A9), Otsuka 944 (A15), and Otsuka 006 (A16) which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Matsuda** This limitation is obvious in light of Matsuda (U.S. Pub. 2010/0038115). As the '541 Patent File History explains: > Matsuda teaches a copper foil suitable for use in collecting materials on lithium ion batteries (¶ 52). **These copper foils ideally have a tensile strength of more than 30 kg-f/mm2** and an elongation of at least 8% (¶ 51). It would have been obvious at the time of invention for one of ordinary skill in the art to create the copper foil of Hirose having the properties as taught by Matsuda because **Matsuda teaches these mechanical properties are ideal for various electronic applications of copper foil (¶ 51).** The ranges taught by Matsuda overlap the claimed ranges, creating a prima facie case of obviousness.

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	'541 Patent File History, SKN-0001767 at SKN-0002320 (Office Action). Applicant did not rebut these assertions and instead initiated an interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at -329 (Applicant-Initiated Interview Summary). **Bennett** Bennett renders this limitation obvious and discloses tensile strengths within the claimed range as well as factors that control tensile strength. > The next important commercial application of this principle was the Elmore process. In this, the cathode was a mandrel, rotating vertically, over which agate burnishers. rotated, keeping the deposited copper tubes smooth, and of constant thickness throughout. This process is used commercially in Europe at present in the manufacture of seamless copper tubes. The current density used is no more than 30 amperes per square foot (3.3 A. per sq. dm.)°. The copper thus obtained has a tensile strength of from 36,000 to 50,000 pounds per square inch (25 to 35 kg. per sq. mm.) depending, it is stated, on the speed of rotation. Bennett, PRIOR_ART-00000126 at PRIOR_ART-00000126. Bennett discloses a tensile strength of 25 – 35 kgf/mm2 using a process used commercially. Bennett states that "it is also known that the tensile strength of steel, copper, etc. is increased by rolling." *Id.* at PRIOR_ART-00000129. ("Hence, with the precipitated copper an increase of tensile strength was expected with a decrease of crystal size, as the rotation was increased. When this was tried the results showed that the theory was correct.")

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	Bennett provides the following figure, showing the increased tensile strength when the revolutions per minute is increased: *Current Density 500 Amperes Per Square Foot.* | Revolutions per Minute	Voltage	Tensile Strength in Vertical Direction: Pounds per Sq. In.	Tensile Strength in Vertical Direction: Kilo per Sq. Mm.	Tensile Strength in Direction of Rotation: Pounds per Sq. In.	Tensile Strength in Direction of Rotation: Kilo. per Sq. Mm.
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1,750	3.2	37,000	25.9	.....	....
2,500	3.8	49,000	34.3	41,000	28.7
3,500	4.7	51,000	35.7	51,000	35.7
5,500	..	58,000	40.6	66,000	46.2	 *Id.* at PRIOR_ART-00000130. In the chart above, Bennett discloses 30 – 40 kgf/mm2 for tensile strength. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[d] so as to prevent the generation of wrinkles at a surface of the copper foil.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in

'541 Patent	Prior Art Disclosures
	light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to prevent wrinkles at a surface of the copper foil to improve battery yield and cycle characteristics, and because wrinkles have historically been understood to be defects. A POSITA could have manufactured a copper foil while preventing wrinkles with a reasonable expectation of success using conventional manufacturing techniques and/or routine experimentation. The references in Appendix A, such as for example, Sano (A18), Hara (A6), Hirose 2009 (A7) and Otsuka 006 (A16) which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. The specification highlights what a POSITA already knew—that wrinkles negatively impact battery yield: > Battey 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. > 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. '541 Patent, PRIOR_ART-00001434 at 1:53-62 (Description of Related Art).

'541 Patent	Prior Art Disclosures
	The references in Appendix A (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. *See, e.g.,* Otsuka 006, PRIOR_ART-00001642 at [007]-[008] [This limitation would have also been obvious in light of Otsuka, which discloses a desired tensile strength in order to reduce wrinkles, stating "[u]p to now, the copper foil used for the cathode collector electrodes of Li-ion batteries has mainly been rolled copper foil. However, the rolled copper foil of a thickness of about 10 μm used for this is expensive. Further, it recrystallizes. Therefore, the tensile strength becomes extremely low. Accordingly, the handling ability in the step of coating and drying the carbon powder or other cathode active materials, then bonding the two by rolling becomes poor, wrinkles are easily caused, and sometimes the foil breaks. As opposed to this, electrodeposited copper foil has a larger tensile strength than rolled copper foil, which drops sharply in tensile strength upon recrystallization, so is superior in handling ability.") For example: **Hirose 2008** Hirose 2008 (US 2008/0050652) discusses the negative effects of wrinkles forming on conductive foil: > For example, in the conductive foil in which the lumpy projections are arranged at random, lamination of a silicon (elemental silicon) layer thereon results in that the lumpy bodies of silicon constituting the silicon layer are also arranged at random. Therefore, stresses generated by expansion of the silicon layer at the time of charging are isotropically exerted in every direction on the conductive film.

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	Accordingly, when the stresses exceed a limit endurable for the conductive foil, various portions of the conductive foil tend to simultaneously extend in various directions. Meanwhile, the overall size of the electrode is limited by an outer package or the like, and extension (elongation) of the conductive foil is also limited. As a result of these factors, the conductive foil undergoes a **wrinkle-like deformation** at the time of charging, **whereby the electrode structure is broken, and the cycle characteristics are lowered**. Hirose 2008, PRIOR_ART-00000478 at [0014] (emphasis added). *See also id.* at [0054]. **Bennett** While not specifically for batteries, Bennett discusses the tensile strength of electrolytic copper and the manufacturing process. The goal of electrolysis to obtain the "deposited copper tubes **smooth**, and of constant thickness throughout." A POSITA would know that a smooth surface does not contain wrinkles. Bennett, PRIOR_ART-00000126 at PRIOR_ART-00000126. **Merchant** A paper published by Merchant, "Elastic and Elastoplastic Response of Thin Copper Foil," discusses copper foil and its mechanical properties. Merchant, PRIOR_ART-00001561. The paper states in its introduction: The primary application for the thin freestanding electrodeposited and rolled copper foils is in the electronic packaging field. Rather than examining the laboratory prepared foil samples, the commercially processed foils, designated by specific grades, are investigated in this paper. They represent a range of grain structures, crystallographic textures and thermal stabilities (of structure and texture), and should help relate the elastic and elastoplastic parameters to the microstructure. During service at and above room

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	temperature, **the thin foil is prone to a variety of failure modes: buckle, dent, wrinkle, warp or curl** (during lamination to polymeric substrate) [32]. One of the aims of this study is to determine the mechanical parameters which govern these failure modes [32]. Merchant, PRIOR_ART-00001561 at PRIOR_ART-00001561(emphasis added). Thus, Merchant explains that, back in 2004, wrinkled copper foils were seen as failures and to be avoided. A POSITA would have been aware that wrinkles were seen as defects. Merchant is also written for the electronic field and is about electrodeposited copper foils. **Chiang** This limitation is also obvious in light of Chiang, which discloses that "[t]he implication of the increase in tensile strength. . . is the significant improvement of its handleability and resistance to plastic deformation under low to medium load conditions. Indeed, fewer wrinkles and other surface defects are being reported by several users of the foil." Chiang, PRIOR_ART-00000162 at PRIOR_ART-00000163. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at

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	least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
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.	To the extent this limitation is found not to be disclosed by any reference in Appendix, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Regarding claim 2, the limitations of claim 1 have been addressed above. A POSITA would have been motivated to have a copper foil with a surface roughness of 2 μm or less because lower surface roughness has been known in the industry to be superior to a higher surface roughness because a lower surface roughness helps to prevent breakage and improve adhesion. Further, surface roughness (Rz-JIS) of 2 μm or less followed from conventional electrolytic manufacturing techniques. A POSITA would have had a reasonable expectation of success in making a copper foil with a surface roughness of 2 μm using conventional copper foil manufacturing techniques and/or routine experimentation. *See, e.g.*, Otsuka 006, PRIOR_ART-00001642 at [0014] (" Surface smoothness: The surfaces of the electrodeposited copper foils disclosed in the above three publications have 10-point average roughnesses Rz smaller than 2.5 μm. . . Note that the 10-point average roughness Rz is the value measured by a surface roughness meter based on JIS-B-0601."); [0020]; [0025]; [0026], Table 1; Hanafusa, PRIOR_ART-00000463 at [0029] (discloses that that surface roughness Rz of the electrolytic copper foil impacts not only the prevention of breakage, but also impacts the "adhesion to a negative-electrode material," and provides a suitable range for Rz of the electrolytic copper foil. Specifically, Hanafusa states that to prevent breakage, "it is desirable that the surface roughness Rz of the electrolytic copper foil is 2.0 μm or less" and that when surface roughness Rz "is less than 1.0 μm, adhesion to a negative-electrode material tends to decrease."); *id.* at [0030] (although these are "optimum numerical conditions," it "should be realized that it is possible to manufacture an electrolytic copper foil that meets numerical conditions different" from those disclosed, "as the need arises." Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of Rz-JIS of 2 μm or less.

'541 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Dobashi (A3), Sano (A18), Hara (A6), Hanafusa (A5), Hirose 2009 (A7), Kato (A9), Hanafusa (A5), Otsuka 944 (A15), Otsuka 006 (A16) which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. This limitation is obvious in light of Hirose 2009 in view of Nishimoto (U.S. Patent 6,451,441). The '541 FH previously found that the surface roughness was obvious in light of prior art: > Hirose does not expressly teach the claimed properties of the copper foil. Nishimoto teaches a metal foil which is bonded to a resin film to form a laminate structure (see col. 1, lines 5-11). The copper foil of Hirose is similarly part of a laminate (see 197). The metal foil can be a copper foil and has a thickness of from 5 to 50 pm (col 5, lines 5-11). . . . The metal foil is coarsened to have a surface roughness of about 0.2 pm to about 0.7 pm (col 5, lines 26-32). It would have been obvious for one of ordinary skill in the art to apply the teachings of Nishimoto regarding the properties of the copper foil to the copper foil of Hirose because Nishimoto discloses conventional characteristics known to result in a working copper laminate and therefore there is a high expectation of success in adopting the same properties. '541 Patent File History, SKN-0001767 at SKN-0002321 (Office Action). *See also id.* at -322-333 (tensile strength range obvious over Battey (US Patent 4,695,348) in view of Matsuda (U.S. Pub. 2010/0038115). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references

'541 Patent	Prior Art Disclosures
	relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to make a copper foil with an elongation of 3 -20 % because such elongation was a conventional property of copper foil, and to promote adhesion between the copper foil and the active material in a battery and improve the amount of charge/discharge cycles of a battery. *See, e.g.*, Otsuka 006, PRIOR_ART-00001642 at Abstract (" An electrodeposited copper foil having an extremely smooth surface roughness at the deposition surface, having an extremely fine crystal structure, and yet not having too high an ordinary temperature tensile strength, superior in elongation, maintaining a stable strength without softening by heat even after heat treatment, and having a high elongation rate even in a high temperature atmosphere."); *id.* at [0022] ("More preferably, the elongation rate at ordinary temperature is at least 14% at a thickness of 35 μm and the elongation rate increases along with a rise in temperature in an atmosphere from ordinary temperature to 200° C."). A POSITA would have had a reasonable expectation of success in making a copper foil with elongation of 3 to 20% using conventional copper foil manufacturing techniques and/or routine experimentation.

'541 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Hirose 2009 (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), and Otsuka 006 (A16), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of elongation. **Matsuda** According to Matsuda, copper foils require a balance of tensile strength and elongation. *See, e.g.*, Matsuda at [0012] ("the copper foil expansion/contraction behavior cannot follow the current collector expansion/ contraction, whereby a phenomenon of the breakage thereof occurs. Therefore, mechanical properties of copper foil as current collecting material, for bearing the repeated expansion/contraction behavior, are required to have a favorable balance between the tensile strength and elongation.") As the Examiner explains in the Non-Final Rejection: > Matsuda teaches a copper foil suitable for use in collecting materials on lithium ion batteries (¶ 52). These copper foils ideally have a tensile strength of more than 30 kg-f/mm2 and **an elongation of at least 8%** (¶ 51). It would have been obvious at the time of invention for one of ordinary skill in the art to create the copper foil of Hirose having the properties as taught by Matsuda because Matsuda teaches these mechanical properties are ideal for various electronic applications of copper foil (¶ 51). The ranges taught by Matsuda overlap the claimed ranges, creating a prima facie case of obviousness. '541 Patent File History, SKN-0001767 at SKN-0002320 (Office Action)

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	Matsuda teaches a copper foil suitable for use in flexible circuit boards and collecting materials on lithium ion batteries (¶ 52). These copper foils ideally have a tensile strength of more than 30 kg-f/mm2 and **an elongation of at least 8%** (¶ 51). It would have been obvious at the time of invention for one of ordinary skill in the art to create the copper foil of Hirose having the properties as taught by Matsuda because **Matsuda teaches these mechanical properties are ideal for various electronic applications of copper foil** (¶ 51). The ranges taught by Matsuda overlap the claimed ranges, creating a prima facie case of obviousness. *Id.* at SKN-0002322. In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at -329 (Applicant-Initiated Interview Summary). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
4. The copper foil for a current collector of a lithium secondary battery according to claim 1, wherein	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in

'541 Patent	Prior Art Disclosures
the copper foil has a thickness of 1 to 35 μm.	light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have a copper foil with a thickness of 1 to 35 μm in battery applications in light of known tradeoffs between lower thicknesses, which allow for higher capacity batteries (e.g., by allowing more current collectors to be stacked/layered in the volume of the battery) and promote flexibility, and higher thicknesses which help avoid strains, breakage and wrinkling. *See, e.g.*, Hirose 2009, PRIOR_ART-00000505 at [0053] (disclosing that it is not desirable to have a thickness "preferably in the range from 10 um to 25um" and challenges with respect to manufacturing batteries using copper foils having thicknesses that are too small or too high). Further, a POSITA would have known that copper foils at the lower end of this range (e.g., less than 10 μm) were particularly vulnerable to wrinkling and difficult to handle. *Cf.* '689 Patent, SKN-0003237 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.");.[1] Hirose 2009, PRIOR_ART-00000505 at [0053] (" If the thickness is smaller than 10 um, the ratio occupied by the anode active material layer 2 is large in the case where the volume of the entire anode is constant and thus such a thickness is preferable to improve the anode performance, while there is a possibility that the anode is subject to thermal damage when forming the anode active material layer 2 by using evaporation method or the like associated with high heat.") Thus, copper foils in battery applications conventionally and often had thicknesses with values falling between 1 to 35 μm (*e.g.,* between 10 - 30 μm). Further, the '541 Patent provides no indication of criticality or unexpected results associated with the claimed range of thickness.

[1] The description in the '689 Patent reflects knowledge that would have been held by a POSITA as of the time of the '541 Patent, notwithstanding the '689 Patent's subsequent filing date.

'541 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Dobashi (A3), Sano (A18), Hara (A6), Hanafusa (A5), Hirose 2009 (A7), Iwama (A8), Kato (A9), Otsuka 944 (A15), and Otsuka 006 (A16), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Nishimoto** As the Examiner explained during prosecution of the application for the '541 Patent, copper foils having a thickness within the claimed range were already known in the art including Nishimoto: > Nishimoto teaches a metal foil which is bonded to a resin film to form a laminate structure (see col. 1, lines 5-11). The copper foil of Hirose is similarly part of a laminate (see 197). **The metal foil can be a copper foil and has a thickness of from 5 to 50 µm** (col 5, lines 5-11). . . . The metal foil is coarsened to have a surface roughness of about 0.2 pm to about 0.7 pm (col 5, lines 26-32). It would have been obvious for one of ordinary skill in the art to apply the teachings of Nishimoto regarding the properties of the copper foil to the copper foil of Hirose because Nishimoto discloses conventional characteristics known to result in a working copper laminate and therefore there is a high expectation of success in adopting the same properties. '541 Patent File History, SKN-0001767 at SKN-0002321 (Office Action) (emphasis added). *See also id.* at -332-333 (thickness range obvious over Battey (U.S. 4,695,348) in view of Matsuda (U.S. Pub 2010/0038115).

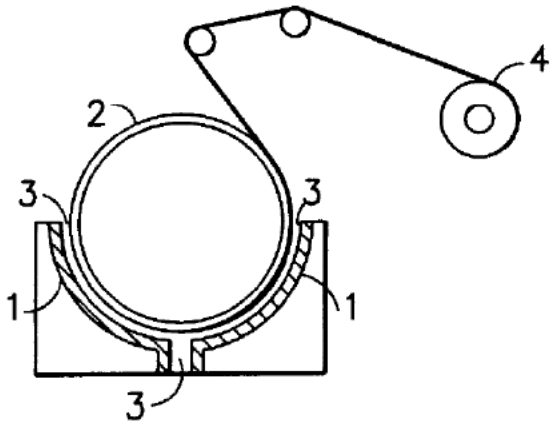
'541 Patent	Prior Art Disclosures
	In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at -329 (Applicant-Initiated Interview Summary). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

U.S. 10,480,090 Secondary References

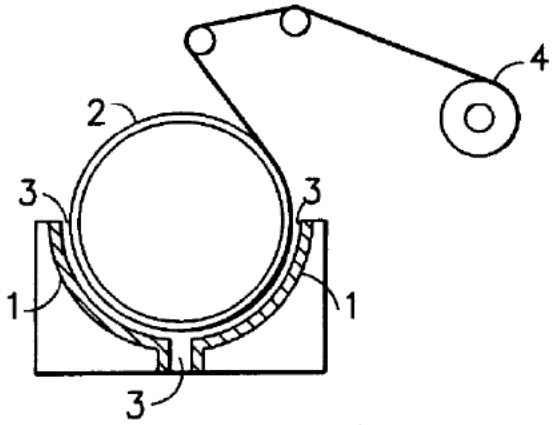
'090 Patent	Prior Art Disclosures
1[pre]. 1. An electrolytic copper foil for a secondary battery, the electrolytic copper foil comprising:	To the extent the preamble of claim 1 is found to be limiting and a reference in Appendix A does not disclose "[a]n electrolytic copper foil for a secondary battery, the electrolytic copper foil comprising," a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. As for the preamble's limitation requiring a "copper foil for a secondary battery," a POSITA would have found it obvious to modify the reference to include this limitation in light of the same references, and for the same reasons, discussed with respect to 1[pre] of the '541 Patent which recites "[a] copper foil for a current collector of a lithium secondary battery" (the discussion of which is incorporated by reference herein). Further, it would have been obvious to make an "electrolytic" copper foil because electrolysis processes were conventionally used by the time of the '090 Patent and led to improved copper foil characteristics (e.g., uniformity, electrical properties). Additionally, the copper foils described by the prior art directed to use in printed circuit boards (PCBs) can be used for secondary batteries. *See, e.g.*, Wolski, PRIOR_ART-00002283 at Abstract; 1:5-18; Dobashi, PRIOR_ART-00000174, at 22:21-24. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Shinozaki (A19), Suzuki (A21), Tani (A20), and Griesi (A23) which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries

'090 Patent	Prior Art Disclosures
	and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[a] a first surface; and	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. It would have been obvious to a POSITA that a copper foil, a flat three-dimensional object, would have two surfaces. A POSITA would have had a reasonable expectation of success in making a copper foil with two surfaces using conventional rolling and electrolytic manufacturing methods. Separately, this limitation is also inherent in copper foils. *See, e.g.*, Shinozaki discloses an "electrolytic copper foil which comprises an untreated copper foil, on the both front and back surfaces," which correspond to the claimed first surface and second surface opposite to the first surface of electrolytic copper foil. Shinozaki, PRIOR_ART-00001756 at [0031]. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), and Griesi (A23), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success.

'090 Patent	Prior Art Disclosures
	Wolski Wolski (U.S. Patent No. 5,834,140 ("Wolski") describes electrodeposited foil and the methods for manufacturing. Thus, Wolski explains why a POSITA would be familiar with copper foil having two surfaces, including "a first surface," or side: > The present invention is an electrodeposited copper foil characterised in that roughening treatment is performed on a matte side of an untreated copper foil wherein the surface roughness R_z of the matte side of the untreated copper foil is the same as or less than the surface roughness R_z of the shiny side of this untreated copper foil. Wolski, PRIOR_ART-00002283 at Abstract. The abstract of Wolski describes two surfaces: a matte side and a shiny side. The surfaces differ because of their contact or lack thereof with the drum. *Id.* at 2:63-66 ("An electrodeposited copper foil can be generally produced by firstly using an electroforming cell as shown in FIG. 1 to produce a copper foil which is called to as an untreated copper foil.").

'090 Patent	Prior Art Disclosures
	 FIG. 1 Thus, a POSITA would know that the copper foil, as a 2-dimensional object, would have two surfaces, noted in their difference by contact with the drum. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

'090 Patent	Prior Art Disclosures
1[b] a second surface opposite to the first surface,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. It would have been obvious to a POSITA that a copper foil would have two surfaces—the surface that comes in contact with the drum and the surface that does not. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), and Griesi (A23), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Wolski** Wolski (U.S. Patent No. 5,834,140 ("Wolski") describes electrodeposited foil and the methods for manufacturing. Wolski explains why a POSITA would be familiar with copper foil having two surfaces, including "a first surface," or side: > The present invention is an electrodeposited copper foil characterised in that roughening treatment is performed on a matte side of an untreated copper foil wherein the surface roughness R_z of the matte side of the untreated copper foil is the same as or less than the surface roughness R_z of the shiny side of this untreated copper foil. Wolski, PRIOR_ART-00002283 at Abstract.

'090 Patent	Prior Art Disclosures
	The abstract of Wolski describes two surfaces: a matte side and a shiny side. The surfaces differ because of their contact or lack thereof with the drum. Id. at 2:63-66 (" An electrodeposited copper foil can be generally produced by firstly using an electroforming cell as shown in FIG. 1 to produce a copper foil which is called to as an untreated copper foil.")  FIG. 1 Thus, a POSITA would know that the copper foil, as a 2-dimensional object, would have two surfaces, noted in their difference by contact with the drum. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to element 1[b] above, it would have been obvious to have a second surface opposite the first surface. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would

'090 Patent	Prior Art Disclosures
	find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have a copper foil with an Rpc for both surfaces within 10 and 100 because it is a known that a high Rpc would result in a lack of uniformity, and a Rpc that is too low would create poor adhesion. A POSITA would have had a reasonable expectation of success in making a copper foil wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100 using conventional copper foil manufacturing techniques and/or routine experimentation. *See, e.g.*, Sano, PRIOR_ART-00001729 at [0008] ("It is within the conventional knowledge that in a process for producing an electrodeposited copper foil . . . the difference in roughness between gloss surface and roughness surface can be made as small as possible."); *id*. at [0006] ("This arises from the request from the view point of improvement in circuit accuracy associated with increased fineness of lines or patterns in the case of printed-wiring board, and arises from the fact that a difference in roughness between gloss surface and roughness surface, namely a difference in battery reaction based on a difference in surface area is no longer necessary to be considered in the case of cathode collector for lithium secondary battery"); Griesi, PRIOR_ART-00000351 at PRIOR_ART-00000381-383 (A POSITA looking to further optimize a copper foil surface (which can serve as a starting point) would have considered Griesi's surface roughness profile data (including Rz value of 1.219 μm) of the untreated electrolytic copper foil. A POSITA would have also recognized another surface roughness-related parameter, Rpc, in Griesi as a

'090 Patent	Prior Art Disclosures
	potentially useful parameter that can be optimized to further enhance uniformity or generally improve a copper foil surface.) In particular, a POSITA would know that surface roughness values like Rpc can be calculated/estimated from Ra values. *See, e.g.*, Shinozaki, PRIOR_ART-00001756 at Table 3 (discloses Ra values comparable to 0.5 µm such that a POSITA would find it obvious to estimate 0.5 criteria line and calculate Rpc values in and around 40-80). Further, the '090 Patent provides no indication of criticality or unexpected results associated with the claimed range of Rpc. Additionally, a POSITA would have a reasonable expectation of success because one would have known how to control Rpc. *See, e.g.*, Dobashi, PRIOR_ART-00000174 at Table 4, [0020]-[0022], [0023]-[0027], [0097] (disclosing that variation of electrolysis solution and/or current densities are factors that contribute to controlling of Sm or Rsm values, which are directly correlated with Rpc values). The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Shinozaki (A19), Dobashi (A3), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Gadelmawla** Gadelmawla informed a POSITA that was well-known that "[b]y controlling spacing parameters [e.g., roughness parameters such as Rpc, Rsm, Sm] it is possible to obtain better bounding of finishes, more uniform finish of plating." Gadelmawla, PRIOR_ART-00000338 at PRIOR_ART-00000345. For instance, prior art emphasizes that "[o]ne of the spacing

'090 Patent	Prior Art Disclosures
	parameter is the peak spacing, which can be an important factor in the performance of friction surfaces." *Id.* **Fabian** A POSITA would be motivated to review Fabian as it was studying the effects of organic additives on the production of void-reduced, smoother, and more uniform copper deposits. Fabian noted that Rpc was used as one of main parameters to evaluate these effects. Fabian, PRIOR_ART-00000326 at PRIOR_ART-00000326 (Abstract) ("The effect of . . . [organic additives such as] Guarfloc66 (Guar) and activated polyacrylamide (APAM) on the topography (surface roughness) of electrodeposited copper was studied," "*The effect of* [organic additives such as] Guar and APAM on surface roughness and *number of Peaks-per-Centimeter*[2] *[corresponding to Ppc or Rpc] was assessed* . . . Observed effects on surface roughness indicate that a *more uniform surface and lower roughness/smoother copper deposits* were obtained using the additive APAM rather than Guar . . . The cross sections of copper deposits from these tests showed that APAM exhibits a *slightly columnar* copper deposit and Guar produced a *porous* copper deposit"), *id.* at PRIOR_ART-00000333 ("It is concluded from these results that *APAM* significantly reduced surface roughness and *increased the number of PPC [Rpc]*. In contrast, *Guar* increased the surface roughness and *decreased the number of PPC similar to the copper deposit produced without additives.*"), *id.* ("The model for the PPC [Rpc] is presented in Eq. (4) . . . [where Ep.(4) corresponds to:] Number of Peaks [Rpc] per Centimetre = 85.2 + 0.313 * A + 8.81 * B (4)," where A is Guar concentration and B is APAM concentration), *id.* at PRIOR_ART-00000334-335 (FIGS. 8, 11). Further, prior art (Fabian) simultaneously discloses a [1] copper foil that can be used for printed circuit board (PCB) and microelectronics, which is compatible with use in secondary batteries and [2] Rpc values of the copper foil that fall within the claimed Rpc range, describing that such Rpc values are useful values *for enhancing uniformity or void reduction of copper foil surface.*

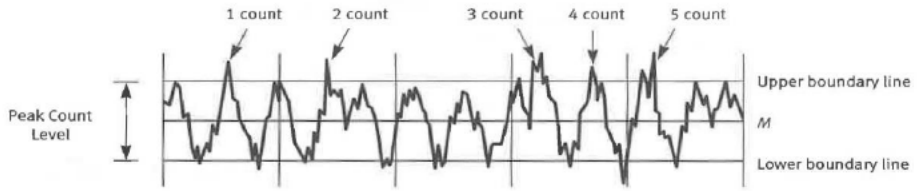
[2] DIN EN ISO 4287, PRIOR_ART-00002398 measurement standard known to share same definition of Rpc describes that the term "Rpc" is also interchangeably used with "PPc" or "WPc." PRIOR_ART-00002398 at -2417-2418.

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	As demonstrated in Fabian, simple variation of concentration of organic additives, such as Guar or APAM, affects Rpc values. *See* Fabian, PRIOR_ART-00000326 at PRIOR_ART-00000326 (" Observed effects on surface roughness indicate that a more uniform surface and lower roughness/smoother copper deposits were obtained using the additive APAM rather than Guar. Regression models indicate APAM has a significant effect on reducing surface roughness at 65 °C.") *id.* at PRIOR_ART-00000333-335. Fabian also discloses making variations of concentrations of organic additives such that the Rpc falls within the claimed range (Rpc of 10-100), thereby contributing to the reasonable expectation of success and the rationale for obviousness. See, e.g., *id.* at -328. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[d] 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,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have found it obvious to determine peak count roughness of each surface using an average of three randomly-selected points to reduce, to some extent, sampling bias.

'090 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Shinozaki (A19), Griesi (A23), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Yacovone** Yacovone, which is directed to measuring roughness in materials science, discloses measuring Rpc of the first and second surfaces utilizing the standards provided in the '090 Patent specification. *See* '090 Patent, SKN-0003228 at 8:6-15. *See, e.g*, Yacovone, PRIOR_ART-00002292 at [0050] ("Another parameter used to describe the polymer interlayer sheet Surface is rough ness peak count (RPC), which is a two dimensional surface measurement parameter that was measured by a Mahr Perthometer S3P device according to the standards SEP 1940:01. 92 and ANSI/ASME B46.1 (1985)"); *id.* at FIGS. 4A to 4F (graphically show the surface peak distribution profiles for different samples, including both regular and random surfaces. FIG. 4A, FIG. 4C and FIG. 4D each show the surface peak distribution profile for different conventional interlayers (Conventional Interlayers B1, B2 and B3 respectively, from Example 1)) **Japanese Industrial Standard (JIS) B 0601-1994 ("JIS Standard 1994") and Operating Instructions MarSurf M 300 + RD 18, Mahr GmbH, 2008 ("MarSurf M300 instruction manual")** The MahrSurf M300 equipment used to determine Rpc [mentioned in the '090 Patent, SKN-0003228 at 8:1-5; Yacovone, PRIOR_ART-00002292 at [0050]] describes that Rsm is shared among different measurement standards, including "JIS B 0601." MahrSurf M300 instruction manual, SKN-0006850 at -891. According to the JIS B 0601 standard, Rsm equates to Sm.

'090 Patent	Prior Art Disclosures
	JIS Standard 1994, PRIOR_ART-00001256 at -271 (defining Sm as "portion equal to the reference length is sampled from the roughness curve in the direction of its mean line and within this sampled portion, the sum of the lengths of mean lines corresponding to one of the profile peaks and one profile valley adjacent to it (hereafter referred to as 'spacing of profile irregularities') is obtained and the arithmetical mean value of many spacings of these irregularities is expressed in millimeter (mm).") Sm, which is used to derive Rpc, is an average value of Sm values measured at multiple randomly selected points, thus rendering this limitation obvious. *See id.* at -271 ("Sm . . . shall be . . . mean value of Sm at ***several places sampled at random*** from the designated surface"). A POSITA would find it obvious and reasonable to make such random measurements at least three locations to reduce sampling bias. Further, the surface roughness manual generally explains that surface roughness parameters are measured according to randomly sampled places. *See id.* at at -258 (explaining that surface roughness parameters correspond to "the parameters expressing the surface roughness at each part sampled randomly from the surface"). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
1[e] the peak count roughness Rpc of each point is the number of effective peaks which rise above	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light

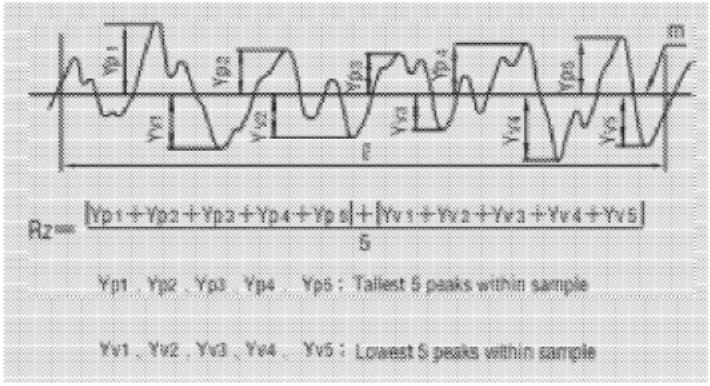
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an upper criteria line of 0.5 μm per unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks.	of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. The references in Appendix A, such as for example, Chou (A2), Dobashi (A3), Griesi (A23), Shinozaki (A19), Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Yacovone** *See, e.g*, Yacovone, PRIOR_ART-00002292 at [0050] ("Another parameter used to describe the polymer interlayer sheet Surface is rough ness peak count (RPC), which is a two dimensional surface measurement parameter that was measured by a Mahr Perthometer S3P device according to the standards SEP 1940:01. 92 and ANSI/ASME B46.1 (1985)"). A POSITA would also know that SEP 1940 is a method to measure Rpc. *See also* HALLE Praziosions-Kalibriernormal GmbH Technical Document on Calibration Standards for Contact-Style Instruments, PRIOR_ART-00000462 at PRIOR_ART-00000462 ("line of products KNT 4058/02 (for the determination of roughness of sheet metal surfaces accord. to SEP No. 1940)") **Japanese Industrial Standard (JIS) B 0601-1994 ("JIS Standard 1994") and Operating Instructions MarSurf M 300 + RD 18, Mahr GmbH, 2008 ("MarSurf M300 instruction manual"), and ASME B46. 1 2002.** An instruction manual for the surface profile measurement equipment (MarSurf M300), from which the '090 Patent derives Rpc data, describes that this Rpc definition is shared by various measurement standards. '090 Patent, SKN-0003228 at 8:1-5 ("Subsequently, the peak count roughness Rpc of the shiny surface and matte surface of the electrolytic copper foils was

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	measured using a MahrSurf M300 roughness tester available from Mahr company and results are shown in the following Table 1." 8:1-5). For instance, the MarSurf M300 instruction manual describes that Rpc is shared by number of different surface roughness measurement standards including "EN 10049: 2005, ASME B46. 1 2002; E DIN EN ISO 4287/A1: 200707 (D)." MarSurf M300 instruction manual, SKN-0006850 at SKN-0006890. Third, other measurement standards, such as ASME B46.1 (2009), provide the same definition of Rpc as recited in the claim language of [1e]. For instance, ASME B 46.1 (2009) refers to "peak density or "Pc" and describes that "the number of SAE peaks per unit length measured at a specified peak count level over the evaluation length," in which SAE peak corresponds to a "profile irregularity wherein the profile intersects consecutively a lower and an upper boundary line . . . located parallel to and equidistant from the profile mean line (see Fig. 1-14)." ASME B46.1 (2009), SKN-0006603 at SKN-0006623-624, FIG. 1-14 (reproduced below). Fig. 1-14 The Peak Count Level, Used for Calculating Peak Density  Accordingly, Rpc (peak count roughness), as claimed in the '090 Patent, is a well-recognized measurement parameter, regardless of whether it is "obtained according to steel iron test schedule (SEP 1940)" or other similar standards. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of

'090 Patent	Prior Art Disclosures
	the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
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.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have a copper foil with a difference in peak count roughness Rpc between the first and second surfaces of 60 or less because having a minimal difference in surface characteristics between the first and second surface helps to avoid a drop in the charge/discharge efficiency of the battery. *See, e.g.*, Sano, PRIOR_ART-00001729 at [0008] ("It is within the conventional knowledge that in a process for producing an electrodeposited copper foil . . . the difference in roughness between gloss surface and roughness surface can be made as small as possible."); *id*. at [0006] ("This arises from the request from the view point of improvement in circuit accuracy associated with increased fineness of lines or patterns in the case of printed-wiring board, and arises from the fact that a difference in roughness between gloss surface and roughness surface, namely a difference in battery reaction based on a difference in surface area is no longer necessary to be considered in the case of cathode collector for lithium secondary battery"); Shinozaki, PRIOR_ART-00001756 at [1004], [0004], [0073], [0074], [0122] (teaching having both surfaces of the electrolytic copper foil exhibiting similar surface characteristics, and that and it was conventional to process both sides to exhibit similar surface roughness characteristics); Griesi PRIOR_ART-00000351 at PRIOR_ART-00000403-404 (discloses untreated copper foil for use in PCB wherein A POSITA looking to further optimize a copper foil surface (which can serve as a starting point) would have considered Griesi's surface roughness profile data (including Rz value of 1.219 μm) of the untreated electrolytic copper foil. A POSITA would have also recognized another surface roughness-related parameter, Rpc, in Griesi as a

'090 Patent	Prior Art Disclosures
	potentially useful parameter that can be optimized to further enhance uniformity or generally improve a copper foil surface.) The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
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.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have a copper foil with a surface roughness of 2 μm or less because lower surface roughness has been known in the industry to be superior to a higher surface roughness. *See, e.g.*, Otsuka 006, PRIOR_ART-00001642 at [0014], [0020], [0025], [0026], Table 1 (disclosing that when surface roughness is too high "the capacity deteriorates and the charge/discharge cycle life drops")

'090 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Hirose 2008** The examiner stated that Hirose 2008 discloses surface roughness Rz. According to paragraph [0026] of Hirose, PRIOR_ART-00000478, the surface roughness Rz is ten-point mean roughness, and the method of measuring ten-point mean roughness (Rz) is well-described in JIS B0601 (1994), available at https://th.misumi-ec.com/pdf/tech/mojd/()9 mol.517.pdf as follows:

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	Ten-point mean roughness (Rz) A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. Then, the average peak is obtained among 5 tallest peaks (Yp), as is the average valley between 5 lowest valleys (Yv). The sum of these two values is expressed in micrometer(μm).  **Fabian** Fabian writes that "[a] surface profile can have the same surface roughness with a different number of PPC [Rpc]." Fabian, PRIOR_ART-00000326 at PRIOR_ART-00000332-333. In other words, a surface profile can have the same Rpc value while having a different surface roughness Rz value, unless Rz value is not significantly changed (e.g., to less than 1 μm) so as to affect the number of peaks that cross the upper and lower criteria lines in Rpc. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of

'090 Patent	Prior Art Disclosures
	the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
4. The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a thickness of 3 to 20 μm and	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. *See* Claim 1. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to claim 4 of the '541 Patent ("the copper foil has a thickness of 1 to 35 μm"). The same motivations for using a thickness of 1 to 35 μm also would have motivated a POSITA to use a thickness of 3 to 20 μm. *See also*, Sano, PRIOR_ART-00001729 at [0059] ("An electrodeposited copper foil having a thickness of 18μm was obtained in the same conditions as employed in the above best mode for carrying out the invention"); Shinozaki, PRIOR_ART-00001756 at [0072], [0073] ("In the present invention, the [current] collector is preferably one having a thin thickness," and "[t]his is because, the strength of the foil cannot be maintained when it is less than 8 μm, therefore breakage occurs at the time of expansion/contraction of the active material. Further, when it exceeds 20 μm, the battery characteristics can be satisfied, but the battery itself becomes large and heavy, therefore, preferably, the thickness is up to about 20 μm.") The references in Appendix A, such as for example, Chou (A2), , Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success.

'090 Patent	Prior Art Disclosures
	Simons Simons teaches that "[t]he most important result of the tensile tests is that the thickness of the foils has an influence on the mechanical behavior in the size regime studied. When the thickness is reduced from 250 to 10 µm the fracture strain decreases for the as-received foils from approximately 20% to 0.2%." and that "[t]he 10 µm as-received foils have the highest tensile strength which is 400 MPa." PRIOR_ART-00000306 at PRIOR_ART-00000307. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
4[b] tensile strength of 30 to 60 kgf/mm2.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. *See* Claim 1. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to claim 1[c] of the '541 Patent ("wherein the copper foil has a tensile strength of 30 to 40 kgf/mm^2"). The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7),

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	Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), and Tani (A20) which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. *See, e.g.*, Ezura, PRIOR_ART-00000311 at Table 1; [0017] ("By increasing the strength of the electrodeposited copper foil, slackness and rupture of the inner lead is inhibited. Therefore if the strength of the electrodeposited copper foil is too low, slackness of the inner lead is produced by plastic deformation, and in the extreme case there is the problem that the foil is ruptured."); A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
5[pre]. A current collector for a secondary battery, the current collector comprising:	To the extent the preamble is found to be limiting and is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have found it obvious to modify each primary reference to use its copper foil for a current collector because it was well-known that copper foils were well-suited to use as a current collector in a lithium secondary battery due to their conductivity and mechanical properties that would permit them to withstand mechanical conventional battery

'090 Patent	Prior Art Disclosures
	manufacturing processes as well as the cycling between battery charged and discharged states. *See, e.g.*, the '541 Patent, which acknowledges in its description of the "Background of The Invention" and "Related Art" that "[a] lithium secondary battery has many advantages such as high energy density, high operation voltage, excellent preservation and excellent life cycle in comparison to other kinds of secondary batteries, so the lithium secondary battery is widely used for various portable electronic devices such as personal computers, camcorders, cellular phones, portable CD players and PDA." '541 Patent, SKN-0003271 at 1:24-30. Further, it acknowledges that "[i]n the lithium secondary battery, a copper foil is mostly used as material of the anode current collector." *Id.* at 1:37-38. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Tani (A20), Dobashi (A3), Griesi (A23), Shinozaki (A19), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. *See, e.g.*, Iwama, PRIOR_ART-00001230 at [0003], [0006], [0036]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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5[a] the electrolytic copper foil according to claim 1; and	Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to Claim 1.
5[b] a protective layer disposed on the electrolytic copper foil,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have found it obvious to add a protective layer to the copper foil to protect against corrosion (e.g., oxidation), and would have had a reasonable expectation of success, because it was conventional and common for copper foils to include protective layers. A POSITA would be motivated to add a protective layer on both surfaces of the copper foil because corrosion would naturally occur on both sides. Further, during prosecution of the '689 Patent, the Examiner found that Oguro (which is also prior art to the '090 Patent) discloses protective layers applied to both sides of copper foil and further that a POSITA would have been motivated to include this limitation to "inhibit the corrosion and raise the rust-prevention of the copper foil": > Iwama does not explicitly teach a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. However, Oguro in the same field of endeavor teaches chromate anti-rust layers applied to both sides of a copper foil. (Oguro in 0085). The skilled artisan would find obvious to modify Iwama with a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. The motivation for such a modification is to inhibit corrosion and raise the rust-prevention of the copper foil. (Oguro in 0135). Iwama's copper layer hence modified teaches or at least suggests a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. '689 Patent File History, SKN-0000001 at SKN-0000388-389 (Non-Final Office Action).

'090 Patent	Prior Art Disclosures
	The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Toshio** Toshio further describes that using a protective layer such as a chromate layer, a benzotriazole layer, or a silane coupling treatment layer on the copper foil provides many advantages including heat resistance, rust prevention, and adhesion enhancement. Toshio, PRIOR_ART-00002138 at [0069], [0074], [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
5[c] wherein the protective layer comprises at least one of chromate, benzotriazole and a silane compound.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA.

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	A POSITA would have known that the protective layer to prevent corrosion and that it should contain at least chromate, benzotriazole, and/or a silane compound as they are known corrosion preventors. *See, e.g., Sasaki,* Formulation of Chromate Conversion Coatings on Aluminum and Its Alloys, PRIOR_ART-00002601. The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hanafusa (A5), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. *See, e.g.*, Dobashi, PRIOR_ART-00000174 at 7:3-15 ("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.") **Toshio** Toshio further describes that using a protective layer such as a chromate layer, a benzotriazole layer, or a silane coupling treatment layer on the copper foil provides many advantages including heat resistance, rust prevention, and adhesion enhancement. Toshio, PRIOR_ART-00002138 at [0069], [0074], [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries

'090 Patent	Prior Art Disclosures
	and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to independent claim 5 and its sub-elements. A POSITA would find it obvious to apply the protective layer to both sides of the copper foil for all the benefits provided above. The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Lee 980 (A14), Saito (A17), Suzuki (A21), Griesi (A23) and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Toshio** Toshio further describes that using a protective layer such as a chromate layer, a benzotriazole layer, or a silane coupling treatment layer on the copper foil provides many advantages including heat resistance, rust prevention, and adhesion enhancement.

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	Toshio, PRIOR_ART-00002138 at [0010]-[0011], [0069], [0074], [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

U.S. 10,811,689 Secondary References

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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 and a reference in Appendix A does not disclose "[a]n electrolytic copper foil for a secondary battery, the electrolytic copper foil comprising," a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. As for the preamble's limitation for an "electrolytic" copper foil, a POSITA would have found it obvious to include this limitation for the same reasons and in view of at least the same references discussed above with respect to [1pre] of the '090 Patent which similarly recites "[a]n electrolytic copper foil." Further, in its "Discussion of Related Art," the '689 Patent discloses that "an electrolytic copper foil having a thickness of 10 μm or less . . . is generally used for manufacturing an anode of a lithium secondary battery . . ." '689 Patent, SKN-0003237 at 1:63-2:3. As for the preamble's limitation for "a first surface and a second surface opposite the first surface," a POSITA would have found this limitation obvious and inherent for the same reasons and in view of at least the same references discussed above with respect to 1[a] and 1[b] of the '090 Patent which, together, similarly recite "a first surface; and a second surface opposite to the first surface." The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success.

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	Oguro Oguro renders this limitation obviousness. Additionally, the '689 Patent File History further demonstrates that a POSITA would have found it obvious for a copper foil to have two surfaces, a matte surface facing the first surface and a shiny surface facing the second surface: > However, Oguro in the same field of endeavor teaches chromate anti-rust layers applied to both sides of a copper foil. (Oguro in 0085). The skilled artisan would find obvious to modify Iwama with a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. The motivation for such a modification is to inhibit corrosion and raise the rust-prevention of the copper foil. (Oguro in 0135). Iwama's copper layer hence modified teaches or at least suggests a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. '689 Patent File History, SKN-0000001 at SKN-0000388-389 (Non-Final Office Action). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1a] a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface;	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA.

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	Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to 1[pre] ("a first surface and a second surface opposite the first surface") and '090 Patent elements 1[a] ("a first surface") and 1[b] ("a second surface opposite to the first surface."). *See, e.g.*, Shinozaki, PRIOR_ART-00001756 at [0054] (disclosing a copper foil having "front and back surfaces . . . "the surface contacting a titanium roll (cathode)" is a "shiny surface or S surface" and "the surface contacting the electrolytic solution" is a "matte surface or M surface."). In addition, a POSITA would have found it obvious to include "a copper layer including a matte surface facing the first surface and a shiny surface facing the second surface" because this was the predictable outcome of conventional electrolytic copper foil manufacturing processes. *See* '689 Patent, SKN-0003237 at 5:16-20 ("The shiny surface SS thereof refers to a surface that comes into contact with the rotating negative electrode drum in an electroplating process, and the matte surface MS refers to a surface opposite the shiny surface SS."); '090 Patent, SKN-0003228 at 4:22-27 ("The electrolytic copper foil 111 of the present invention may be formed on a rotational anode drum by electroplating, thereby having a first surface (also called a "shiny surface") 111*a* which contacts the rotational anode drum in the process of electroplating and a second surface (also called a 'matte surface') 111*b* opposite to the first surface."). Indeed, during prosecution of the '689 Patent, the Examiner found that Oguro renders this limitation obvious. '689 Patent File History, SKN-0000001 at SKN-0000389 (Non-Final Office Action) ("Oguro in the same field of endeavor teaches chromate anti-rust layers applied to both sides of a copper foil. (Oguro in 0085)."). *See also, e.g.*, Shinozaki discloses a copper foil having "front and back surfaces . . . the surface contacting a titanium roll (cathode) [is a] shiny surface or S surface [and] the surface contacting the electrolytic solution [is a] matte surface or M surface." Shinozaki, PRIOR_ART-00001756 at [0031], [0054]. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Griesi (A23), Cheng (A1), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and

'689 Patent	Prior Art Disclosures
	additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Applicant Admitted Prior Art** The Applicant Admitted Prior Art renders this limitation obvious. *See, e.g.*, '689 Patent, SKN-0003237 at 1:63-2:3 ("an electrolytic copper foil having a thickness of 10 μm or less . . . is generally used for manufacturing an anode of a lithium secondary battery . . ."). **Wolski** Wolski, under "Prior Art", explains that a POSITA would be motivated to manufacture a copper foil for current collection using a rotating cathode drum. > An electrodeposited copper foil for a printed circuit has been produced industrially by filling a gap between an insoluble electrode such as a lead electrode or a titanium electrode covered with a platinum group metal and a rotating cathode drum which is made of stainless steel or titanium and opposed to the insoluble electrode, with an electrolyte of a copper sulfate aqueous solution, passing electricity to these electrodes to electrodeposit copper on the rotating cathode drum and peeling off the electrodeposited copper continuously. Wolski, PRIOR_ART-00002283 at 1:19-30. Wolski goes on to show why it would be obvious to obtain a copper layer with a matte side and a shiny side when using a rotating drum: > In general, in the untreated copper foil, the so-called shiny side which is a surface at the side contacting with the drum has a relatively smooth surface, but at the reverse surface called a matte Side, unevennessis relatively remarkable. *Id.* at 3:55-58.

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	Because the '689 Patent teaches use of a rotating drum, *see, e.g.*, '689 Patent, SKN-0003237 at 3:21-40; 3:41-42; 5:14-20; 8:14-19, a POSITA would have a reasonable expectation of success to have a copper foil with a matte side and shiny side. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1b] a first protective layer on the matte surface of the copper layer; and	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to the '090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper foil."). It would have been obvious to include a protective layer on both the shiny and matte sides of the copper foil for the same reasons discussed with respect to those claim elements. *See, e.g.*, Kim 887 (A12), PRIOR_ART-00001429 at [0007], [0024], [0025], [0028] ("Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance," "the surface of the copper foil is chromated to prevent corrosion"). The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Saito

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	(A17), Suzuki (A21), Griesi (A23), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Toshio** Toshio renders this limitation obvious. According to Toshia, active material can be formed on both surfaces of the current collector substrate and protective layer such as anti-rust layer or corrosion-proof layer can be applied in between the copper foil surfaces of the current collector and the active material layer. Toshio, PRIOR_ART-00002138 at [0023] ("a silicone-based active material film is formed on one or both sides of a current collector substrate using copper foil with a rough surface"), [0069], [0074] ("Rust prevention treatment may be performed on the heat resistance or heat resistance barrier treatment layer. This is because it is not limited to forming the active material film immediately after manufacturing the current collector. A rust prevention layer is obtained by forming a thin layer with a passivation function using an organic film or an inorganic film dielectric"), [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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[1c] a second protective layer on the shiny surface of the copper layer,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to 1[b] ("a first protective layer on the matte surface of the copper layer") as well as the '090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper foil."). It would have been obvious to include a protective layer on both the shiny and matte sides of the copper foil for the same reasons discussed with respect to those claim elements. *See, e.g.*, Kim 887 (A12), PRIOR_ART-00001429 at [0007], [0024], [0025], [0028] ("Also, the electrodeposited copper foil is additionally coated with a protective layer at a post-processing so as to ensure corrosion resistance," "the surface of the copper foil is chromated to prevent corrosion"). **Oguro** Indeed, as the prosecution history explains: > Oguro in the same field of endeavor teaches chromate anti-rust layers applied to both sides of a copper foil. Oguro at [0085]. The skilled artisan would find obvious to modify Iwama with a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. The motivation for such a modification is to inhibit corrosion and raise the rust-prevention of the copper foil. (Oguro in 0135). Iwama's copper layer hence modified teaches or at least suggests a first protective layer on the matte surface of the copper layer and a second protective layer on the shiny surface of the copper layer. '689 Patent File History, SKN-0000001 at SKN-0000388-389 (Non-Final Office Action) The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Saito (A17), Suzuki (A21), Griesi (A23), Tani (A20), which have been separately charted and are

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	incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Toshio** Toshio renders this limitation obvious. According to Toshia, active material can be formed on both surfaces of the current collector substrate and protective layer such as anti-rust layer or corrosion-proof layer can be applied in between the copper foil surfaces of the current collector and the active material layer. Toshio, PRIOR_ART-00002138 at [0023] ("a silicone-based active material film is formed on one or both sides of a current collector substrate using copper foil with a rough surface"), [0069], [0074] ("Rust prevention treatment may be performed on the heat resistance or heat resistance barrier treatment layer. This is because it is not limited to forming the active material film immediately after manufacturing the current collector. A rust prevention layer is obtained by forming a thin layer with a passivation function using an organic film or an inorganic film dielectric"), [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1d] wherein: a coefficient of thermal expansion of the electrolytic copper foil, which	To the extent the limitation of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to

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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.),	include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have found it obvious to modify each reference in Appendix A to include this limitation for copper foil applications in batteries and understood that the copper foils disclosed in these references had a coefficient of thermal expansion within the claimed range. A POSITA understood that the coefficient of thermal expansion of a copper foil (including that 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) quantifies the amount of expansion of copper foil in response to a change in temperature. In the process of battery manufacture and use, copper foils are obviously and conventionally adhered to active material and undergo temperature changes. A POSITA would have known that the coefficient of thermal expansion affects the copper foil (including, e.g., whether it curls or wrinkles) as well as how well it can be coated with and adhered to the active material. A POSITA thus would have found it obvious to try through routine experimentation a coefficient of thermal expansion within the claimed range of 16 to 22 μm/(m-° C. A POSITA could have manufactured a copper foil having a coefficient of thermal expansion in the claimed range with a reasonable expectation of success using conventional manufacturing techniques and/or routine experimentation. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of thermal expansion coefficients. The references in Appendix A, such as for example, Sano (A18), Ezura (A4), Hirose 2009 (A7),Otsuka 006 (A16), Suzuki (A21), Saito (A17), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Laser and Optic's User Manual** The Laser and Optic's User Manual further shows that the a POSITA would have understood that the copper foils disclosed in Appendix A would have had a coefficient of thermal expansion of 16 to 22 μm/(m-° C.) when measured using a thermomechanical analyzer (TMA) while heating the

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	electrolytic copper foil from 30º C. to 190º C. at a speed of 5º C/min, or that such ranges would have been obvious to try and the result of routine experimentation. : > Iwama does not explicitly teach a coefficient of thermal expansion of the electrolytic foil which ranges from 16 to 22 pm /(m-°C). However, the Laser and Optics User's Manual teaches that copper has a thermal expansion coefficient of 16.5 ppm/°C and higher, which is equal to 16.5 pm /(m'°C), which teaches or at least suggests the claimed range of 16 to 22 pm /(m-°C). ***In view of the Laser and Optics User's Manual, it would naturally flow for copper to have a coefficient of thermal expansion within applicant's claimed range, inherently, absent of a showing by applicant that the claimed invention distinguishes over the reference***. . . . As to the thermal expansion being 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, the examiner notes that these limitations have not been given patentable weight within the context of claim 1, as such limitations are considered process limitations which fail to further limit or give patentable scope to the electrolytic copper foil. ’689 Patent File History, SKN-0000001 at SKN0000389. **Khatibi** Khatibi renders this limitation obvious and further shows that the a POSITA would have understood that the copper foils disclosed in Appendix A would have had a coefficient of thermal expansion of 16 to 22 µm/(m-º C.) when 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, or that such ranges would have been obvious to try and the result of routine experimentation. Khatibi describes that “[t]he aim of present study was to outline the impact of manufacturing process of thin copper foils on the temperature dependency of E and CTE up to 200°C and investigate the correlation between their properties in this temperature range.” Khatibi, PRIOR_ART-00001393 at PRIOR_ART-00001394.

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As part of the results of Khatibi's study, the CTE of electrodeposited copper foils is shown as a function of test temperature. *Id.*, at PRIOR_ART-00001396, Table 2 (annotated, reproduced below). In Table 2, electrolytic copper foil is designated as DF. *Id.* at PRIOR_ART-00001394.

Table 2: Results of E and CTE measurements for rolled and electrodeposited Cu foils as a function of test temperature

	CTE(ppm/K)			E(GPa)		
Designation	**RT**	**100°C**	**200°C**	**RT**	**100°C**	**200°C**
12µm-TPC-none	16,6	17,9	19,6	101		
18µm-TPC-none	14,8	20,3	27,6	100		
35µm-TPC-none	15,7	18,1	21,3	101		
12µm-TPC-300°C-30min	16,3	17,1	18,2	108	90	82
18µm-TPC-300°C-30min	17,1	18,1	19,7	101	84	77
35µm-TPC-300°C-30min	14,9	16,5	18,7	101	83	74
12µm-TPC-900°C-30min	15,5	17,2	19,5	87	75	68
18µm-TPC-900°C-30min	17,2	18,2	19,6	74	74	68
35µm-TPC-900°C-30min	14,3	17,1	20,9	79	61	68
12µm-DF-300°C-30min				111	98	69
18µm-DF-300°C-30min				93	87	67
35µm-DF-300°C-30min				96	79	58
12µm-DF-900°C-30min	15,8	16,9	18,39	105	84	68
18µm-DF-900°C-30min	17,1	18,0	19,2	86	77	58
35µm-DF-900°C-30min	16,9	17,4	18,1	90	69	61
200µm-DF-300°C-30min	16,7	16,8	16,9	120	106	91
Bulk copper	16,6	17,4	18,0	93	96	86

Accordingly, Khatibi discloses the characteristics of CTE of electrodeposited copper foils as a function of temperature and thickness.

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	Khatibi discloses the characteristics of the CTE of electrolytic copper foils having thicknesses similar to the claimed electrolytic copper foils, and thus Khatibi is a relevant disclosure that can relate to the Coefficient of Thermal Expansion ("CTE") the electrolytic copper foils. Further, Khatibi discloses CTE values that fall within the claimed range. For instance, Khatibi discloses CTE values such as 15.8 ppm/K (corresponding to 15.8 μm/(m·° C))), 16.9 ppm/K, and 18.39 ppm/K at 25 °C, 100 °C, and 200 °C, respectively, for the electrolytic copper foil having a thickness of 12 μm. *See* Khatibi at Table 2 (annotated, reproduced below). Moreover, for instance, Khatibi discloses CTE values such as 17.1 ppm/K, 18.0 ppm/K, and 19.2 ppm/K at 25 °C, 100 °C, and 200 °C, respectively, for the electrolytic copper foil having a thickness of 18 μm. *Id.* A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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/mm^2,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA making copper foil for a battery application would have found it obvious to use a heat treatment, including at a temperature of 190º C for 1 hour, to improve the mechanical properties of the copper foil and its ability to conduct currents. A POSITA would have known that understood

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	that following a heat treatment would lessen the tensile strength and thus be motivation to obtain untreated copper foils with higher tensile strength such that, following a heat treatment, the copper foils still exhibit tensile strengths within the claimed range. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of tensile strength, The references in Appendix A, such as for example, Shinozaki (A19), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Bennett** Bennett explains that a "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." Bennet, PRIOR_ART-00000126 at PRIOR_ART-00000137. Thus, a POSITA would know that because adding heat causes "soft" copper with a lower tensile strength, it would be obvious to the POSITA to slowly heat the copper foil over time just as the claimed method does. **Lee 980** The '689 File History states that Lee renders this limitation obvious. As the prosecution history explains: Lee in the same field of endeavor teaches a tensile strength of electrolytic copper foil as 85% to 99% of the tensile strength (40 kgf/mm2 to 70 kgf/mm2) before a heat

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	treatment step, the lower endpoint equating to 34 kgf/mm2 which overlaps with applicant's claimed range. (Lee in 0018) Furthermore, the extent that the claimed prior art range and the prior art range do not overlap are considered close enough that one skilled in the art would have expected them to have the same properties, thereby establishing a prima facie case of obviousness. . . . The skilled artisan would find obvious to modify Iwama so that the electrolytic copper foil has a tensile strength ranging from 21 to 36 kgf/mm2. The motivation for such a modification is for high mechanical strength. (Lee in 0051) '689 Patent File History, SKN-0000001 at SKN0000390. **Matsuda** Matsuda explains how treating an electrodeposited copper foil using 180 degrees, which is comparable to the claimed 150 degrees, for one hour (60 minutes) results in improved current collecting while still having enough tensile strength to be employed in a battery that expands/contracts. In the present invention, by optimizing the manufacturing condition, the electrodeposited copper foil can be provided with a more excellent mechanical properties of a tensile strength as received of not less than 38 kgf/mm and that after heating (180°C.x60 min, in the air) of not less than 33 kgf/mm. Therefore, thisfavorable mechanical properties can not only fully bear bending usage of flexible printed wiring boards, but also are suitable for an application to current collecting materials constituting cathodes of lithium ion secondary batteries, which are subjected to the expansion/ contraction behavior. Matsuda, PRIOR_ART-00001544 at [0052].

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	For example, one of the benefits that Matsuda teaches a POSITA that heat treatments provide is that they increase elongation %, which is a notable mechanical property. *See, e.g.*, '689 Patent, SKN-0003237 at Claim 2.

TABLE 2

	Copper foil	Electrodeposited copper foil property			
		As received		After heating (180° C. × 60 min.)	
	thickness (micron meter)	Tensile strength (kgf/mm^2)	Elongation (%)	Tensile strength (kgf/mm^2)	Elongation (%)
Example 1	12	38.2	6.2	34.6	9.8
Example 3	12	36.6	8.2	32.9	10.3
Example 5	12	39.3	8.1	34.3	11.0
Example 7	12	35.3	7.7	31.7	10.5
Example 9	12	36.7	7.9	32.2	11.0
Comparative Example 1	12	36.2	4.0	32.4	5.6
Comparative Example 2	12	31.4	3.5	26.8	5.8
Comparative Example 3	12	40.5	3.6	39.5	4.4
Comparative Example 4	12	38.6	4.0	37.4	4.8

Matsuda, PRIOR_ART-00001544 at Table 2 above shows a slight degree in tensile strength following a heat treatment for on hour, but also an increase in elongation %.

A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the

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	art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1f] a weight deviation of the electrolytic copper foil is 5% or less,	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '541 Patent, Claim 1[c] ("weight deviation of 3% or less"). A POSITA would have been motivated to achieve a weight deviation of 5% or less. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of weight deviation. The references in Appendix A, such as for example, Chou (A2), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Kim 541 (A10), Lai (A13), Suzuki (A21), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Kohiki** As the prosecution history explains: > Kohiki in the same field of endeavor teaches a weight deviation of 0.05 g/dm or less, which relative to a foil weight of 2.75 g/dm^2 equates to a weight deviation of 1.8%. Kohiki at [0068] The skilled artisan would find obvious to modify the electrolytic copper foil of Iwama to have a weight deviation of 5% or less. The motivation for such a modification is to improve the foil thickness precision. Kohiki at [0074]. '689 Patent File History, SKN-0000001 at SKN-0000347 (Non-Final Office Action)

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	The references in Appendix A (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. As an initial matter, according to the '689 Patent: > In the present invention, the "peak count (Pc)" may be obtained by measuring peak counts (Pc) of any three points on the surface of the electrolytic copper foil 110 and calculating an average value of measured values of the peak counts (Pc). The peak count (Pc) of each of the points is the number of effective peaks P1, P2, P3, and P4 which rise above a 0.5 μm upper criteria line C1 per 4 mm unit sample length in a surface roughness profile obtained according to U.S. standard ASME B46.1-2009. In this case, at least one valley deeper than a −0.5 μm lower criteria line C2 exists

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	between adjacent effective peaks among the effective peaks. When there is no valley deeper than the −0.5 μm lower criteria line C2 between adjacent peaks which rise above the upper criteria line C1, all of the adjacent peaks may not be "effective peaks" used for measuring the peak count (Pc), and relatively lower peaks among the peaks are ignored when obtaining the number of "effective peaks. '689 Patent, SKN-0003237 at 7:43-59. This peak count (Pc) can be deemed identical to the Rpc (peak count roughness) feature in the inventor's other issued patent, U.S. Patent No. 10,480,090 (the '090 Patent). For instance, according to the '090 Patent: 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. '090 Patent, SKN-0003228 at claim 1. Therefore, according to the Asserted Patents, Pc and Rpc provide the same measurement and can be used interchangeably or, at least, can be used to estimate the other. A POSITA would have been motivated to have a copper foil with a peak count ranging from 3 to 92 for substantially the same reasons provided in this chart when addressing '090 Patent, claims 1[c], 1[d], and 1[e], and thus this section incorporates all references and reasonings from '090 Patent, claims 1[c], 1[d], and 1[e] herein. Additionally, '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of Pc.

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	The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 541 (A10), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. For example: > As to a peak count of each of the first and second surfaces of the electrolytic copper foil ranging from 3 to 92, applicant's specification defines peak count as the number of effective peaks which rise above 0.5 pm in a surface roughness profile, (specification in [0065]) To this end, as Hirose teaches a surface roughness of 1.5 pm to 5 pm (Hirose in 0026), absent of unexpected results it is asserted that the peak count is an optimizable parameter for a result effective variable. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) A patent claim can be proved obvious merely by showing that the combination of elements was obvious to try. . . Furthermore, absent of unexpected results it is asserted that surface roughness, and hence the number of effective peaks which rise above 0.5 pm in a surface roughness profile, is an optimizable parameter for a result effective variable. . . The skilled artisan would find obvious to optimize the peak count of copper in view of Hirose teaching a surface roughness of 1.5 pm to 5 pm directly affecting adhesion and cracking on expansion. Hirose at [0026]. '689 Patent File History, SKN-0000001 at SKN-000349 (Non-Final Office Action) Furthermore, additional references made this limitation obvious. **<u>Yacavone</u>** Yacovone (US20140302281) discloses the claimed "peak count roughness Rpc" was a well-known concept in the field of polymer/material science, and further discloses that Rz (e.g., 10-point

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	roughness) value alone does not characterize the complete profile of the surface, it would have been obvious for POSITA to use both Rz and Rpc when testing surface roughness to improve coatability and adhesion properties of the surfaces of the electrolytic copper foil. *See, e.g*, Yacovone, PRIOR_ART-00002292 at [0050] ("Another parameter used to describe the polymer interlayer sheet Surface is rough ness peak count (RPC), which is a two dimensional surface measurement parameter that was measured by a Mahr Perthometer S3P device according to the standards SEP 1940:01. 92 and ANSI/ASME B46.1 (1985)"); *id.* ("In some embodiments, the surface will have an R PC value (roughness peaks) of at least 300, or at least 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95 or at least 100.") The references in Appendix A (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1h] each of the first and second surfaces has a surface roughness (Rz) of 3.5 μm or less.	To the extent the limitation of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA.

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	Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to the '541 Patent, claims 2 ("a first surface and a second surface opposite the first surface") and '090 Patent elements 1[c] ("a first surface") and 3 ("a second surface opposite to the first surface."). As explained above, a POSITA would have been motivated to manufacture a copper foil with its first and second surfaces having a surface roughness (Rz) of 3.5 μm or less, and a POSITA would have a reasonable expectation of success in achieving a copper foil wherein the surface roughness (Rz) is within the range of 3.5 μm or less. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of Rz. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Shinozaki (A19), Saito (A17), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Iwama** As the prosecution history explains: > In Iwama, each of the first and second surfaces has a surface roughness (Rz) of 2.0 pm and 2.5 pm, respectively, which teaches or at least suggests the claimed range of 3.5 pm or less. (Iwama in 0038). '689 Patent File History, SKN-0000001 at SKN-0000349 (Non-Final Office Action).

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	A POSITA would have a reasonable expectation of success by incorporating the practices for lowering the surface roughness for substantially the same reasons provided in this chart when addressing '090 Patent, claims 1[c], 1[d], and 1[e], and thus this section incorporates all references and reasonings from '090 Patent, claims 1[c], 1[d], and 1[e] herein. **Fabian** Fabian explains that "[a] surface profile can have the same surface roughness with a different number of PPC [Pc or Rpc]." Fabian, PRIOR_ART-00000326 at PRIOR_ART-00000332-333. In other words, A POSA would know that a surface profile can have the same Pc value while having a different surface roughness Rz value, unless Rz value is not significantly changed (e.g., to less than 1 μm) so as to affect the number of peaks that cross the upper and lower criteria lines in Rpc. Accordingly, Rz of 1.0-5 μm partially overlaps with claimed range of "3.5 μm or less." The references in Appendix A (which have been separately charted and are incorporated by reference herein), as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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[Claim 2] The electrolytic copper foil of claim 1, having an elongation of 3% or more at room temperature.	To the extent the limitation of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendant incorporates by reference all secondary references, evidence and obviousness arguments cited for the'541 Patent, claim 3 ("the copper foil has an elongation of 3 to 20%."). It would have been obvious to have an elongation value greater than 3% at room temperature. *See also*, Shinozaki, PRIOR_ART-00001756 at [0050], [0051] ("the copper foil is preferably electrolytic copper foil which has . . . an elongation of 4.0% or more."). The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of elongation. **Oguro** As the prosecution history explains: > Oguro teaches an elongation rate of 3.5% or more at 25°C, which teaches or at least suggests an elongation of 3% or more at room temperature. (Oguro in 0193) The skilled artisan would find obvious to modify Iwama with an elongation of 3% or more at room temperature. The motivation for such a modification is to the elongation of the electrolytic foil directly affecting adhesion of the active material. (Oguro in 0194) '689 Patent File History, SKN-0000001 at SKN-0000347 (Non-Final Office Action).

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	A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to the '090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper foil."). It would have been obvious to a POSITA include a protective layer on both the shiny and matte sides of the copper foil for the same reasons discussed with respect to those claim elements. It also would have been obvious to a POSITA to include at least one of chromium (Cr), a silane compound, and a nitrogen compound in the protective layer because these use of these compounds was conventional and known in the industry to prevent corrosion and rust, and improve adhesion. For this same reason, a POSITA would have a reasonable expectation of success. The references in Appendix A, such as for example, Sano (A18), Kim 887 (A12), Hanufasa (A5), Ezura (A4), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Lee 980 (A14), Saito (A17), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and

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	additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Oguro** In Oguro, the protective layers include a chromium-based solution, which teaches or at least suggests each of the first and second protective layers include at least one of chromium, a silane compound, and a nitrogen compound. (Oguro in 0085-0087). '689 Patent File History, SKN-0000001 at SKN-0000347 (Non-Final Office Action). **Toshio** Toshio (KR2012/0003485A) teaches using a protective layer such as a chromate layer, a benzotriazole layer, or a silane coupling treatment layer on the copper foil and describes advantages including heat resistance, rust prevention, and adhesion enhancement. Toshio, PRIOR_ART-00002138 at [0069], [0074], [0091]-[0093]. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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[Claim 4] The electrolytic copper foil of claim 1, having a thickness of 4 to 30 μm.	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to element 1[b] above, and the '541 Patent, claim 4 ("wherein the copper foil has a thickness of 1 to 35 μm..."). It would have been obvious to have a thickness of 4 to 30 μm for the same reasons discussed with respect to those claim elements. Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of thickness. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanufasa (A5), Cheng (A1),Ezura (A4), Hirose 2009 (A7), Kato (A9), Iwama (A8), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Iwama** The prosecution history for this patent shows: > In Iwama, the electrolytic copper foil has a thickness 10 to 25 pm, which teaches or at least suggests a thickness of 4 to 30 pm to the extent that Iwama's thickness range overlaps therewith. (Iwama in 0045). '689 Patent File History, SKN-0000001 at SKN-0000348 (Non-Final Office Action).

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	A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[5] The electrolytic copper foil of claim 1, having a coefficient of thermal expansion of 17.3 to 22 µm/(m-° C.).	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to the '689 Patent, claim 1[d]. ("a coefficient of thermal expansion of the electrolytic copper foil. . . rang[ing] from 16 to 22 µm/(m-° C".)) Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of thermal expansion coefficients. The references in Appendix A, such as for example, Sano (A18), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading,

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	which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

U.S. 11,346,014 Secondary References

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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 and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to element [1pre] of the '689 Patent ("An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising"). The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Kim 761 (A11), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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[1a] a first protective layer at the first surface;	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to'090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper foil."),'689 Patent element 1[b] ("a first protective layer on the matte surface of the copper layer") and '689 Patent element 1[c] ("a second protective layer on the shiny surface of the copper layer"). A POSITA would have been motivated to add a protective layer on both surfaces of the copper film to slow down degradation from elements and wear. *See, e.g.*, Hanafusa, PRIOR_ART-00000463 at [0031]-[0034], [0004], [0013], [0024] ("to prevent surface oxidation of the electrolytic copper foil" and that "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."). The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Kim 761 (A11), Ezura (A4), Hanafusa (A5), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Lee 980 (A14), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Hua (EP 3633438 A1)** Hua, which is directed to copper foils for a secondary battery, discloses a first and second protective layer. For convenience of description, among two anticorrosive layers 211 and 212, the anticorrosive layer 211 disposed on the matte surface MS of the copper layer 110 is referred

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	to as a 'first protective layer' and the anticorrosive layer 212 disposed on the shiny surface SS is referred to as a 'second protective layer'. Hua, PRIOR_ART-00000276 at [01000] **Seung** Seung (KR 2017-0053888) teaches an electrolytic copper foil having a first and second protective layer. Seung, PRIOR_ART-00001741 at Abstract. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1b] a second protective layer at the second surface; and	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to'090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper

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	foil."),'689 Patent element 1[b] ("a first protective layer on the matte surface of the copper layer") and '689 Patent element 1[c] ("a second protective layer on the shiny surface of the copper layer") and '014 Patent element 1[a] ("a first protective layer at the first surface"). A POSITA would have been motivated to add a protective layer on both surfaces of the copper film to slow down degradation from elements and wear. *See, e.g.*, Hanafusa (U.S. Pub. 2010/0136434) at [0031]-[0034], [0004], [0013], [0024] ("to prevent surface oxidation of the electrolytic copper foil" and that "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."). The references in Appendix A, such as for example, Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Kim 761 (A11), Ezura (A4), Hanafusa (A5), Hirose 2009 (A7), Kato (A9), Kim 541 (A10), Lee 980 (A14), Suzuki (A21), and Griesi (A23), Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Hua (EP 3633438 A1)** Hua, which is directed to copper foils for a secondary battery, discloses a first and second protective layer. > For convenience of description, among two anticorrosive layers 211 and 212, the anticorrosive layer 211 disposed on the matte surface MS of the copper layer 110 is referred to as a 'first protective layer' and the anticorrosive layer 212 disposed on the shiny surface SS is referred to as a 'second protective layer'. Hua, PRIOR_ART-00000276 at [01000] **Seung**

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	Seung (KR 2017-0053888) teaches an electrolytic copper foil having a first and second protective layer. PRIOR_ART-00001741 at Abstract. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1c] a copper film disposed between the first and second protective layers, wherein	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants further incorporate by reference the secondary references, evidence and arguments discussed above with respect to '090 Patent element 5[b] ("a protective layer disposed on the electrolytic copper foil."),'689 Patent element 1[b] ("a first protective layer on the matte surface of the copper layer") and '689 Patent element 1[c] ("a second protective layer on the shiny surface of the copper layer") and '014 Patent element 1[a] ("a first protective layer at the first surface"). A POSITA would have been motivated to add a protective layer on both surfaces of the copper film to slow down degradation from elements and wear. *See, e.g.*, Hanafusa, PRIOR_ART-00000463 at [0031]-[0034], [0004], [0013], [0024] ("to prevent surface oxidation of the electrolytic copper foil" and that "if

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	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.”). The references in Appendix A, such as for example, Shinozaki (A19), Sano (A18), Kim 887 (A12), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Griesi (A23), and Lee 980 (A14), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Hua (EP 3633438 A1)** Hua, which is directed to copper foils for a secondary battery, discloses a first and second protective layer. > For convenience of description, among two anticorrosive layers 211 and 212, the anticorrosive layer 211 disposed on the matte surface MS of the copper layer 110 is referred to as a ‘first protective layer’ and the anticorrosive layer 212 disposed on the shiny surface SS is referred to as a ‘second protective layer’. Hua, PRIOR_ART-00000276 at [01000] **Seung** Seung (KR 2017-0053888) teaches an electrolytic copper foil having a first and second protective layer. PRIOR_ART-00001741 at Abstract. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at

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	least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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,	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed in '541 Patent, Claim 2 ("a surface roughness (Rz-JIS) of 2 μm or less"); '090 Patent, Claim 1[c] ("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"); '689 Patent, Claim 3 ("wherein each of the first and second protective layers includes at least one of chromium (Cr), a silane compound, and a nitrogen compound"); '706 Patent, Claim 1[c] ("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"). A POSITA would have been motivated to have a copper foil with a binding coefficient of the electrolytic copper foil at the first surface or the second surface of 1.5 to 9.4 because the Rp, peak density, and Cr values required to obtain a binding coefficient in the claimed range are obvious and desirable to improve adhesion and prevent corrosion. It would have been obvious to a POSITA to have an Rp and peak density, both surface roughness characteristics, in the claimed range because it is preferable to have a foil with a low surface roughness profile, which has been known in the industry to be superior to a higher surface roughness because a lower surface roughness helps to prevent breakage and improve adhesion. It would have been obvious to a POSITA to have Cr in the claimed range because a POSITA would have understood that Cr is commonly used in anti-corrosion protective layers, and would have known the

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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).	necessary amount of chromium required for the disclosed protective layer to prevent corrosion and rust. ." Further, the '014 Patent provides no indication of criticality or unexpected results associated with the claimed range of binding coefficients. A POSITA would have had a reasonable expectation of success because the claimed ranges for Rp, peak density, and Cr are well known in the industry, as explained above, and plugging those measurements into the equation disclosed in this limitation would result in a binding coefficient of 1.5 to 9.4. The references in Appendix A, such as for example, Chou (A2), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Kim 761 (A11), and Suzuki (A21), Griesi (A23), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[Claim 2] The electrolytic copper foil according to claim 1, wherein an X-ray	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA.

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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	Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '541 Patent element 1[b] ("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%"). A POSITA would have been motivated to have a copper foil with a texture coefficient of (220) plane of the electrolytic copper foil of 0.49 to 1.28 because they would know that optimizing a copper foil to have such a texture coefficient would result in increased elongation, low surface roughness, and a small surface roughness difference between the two surfaces. A POSITA would understand that these properties would result in a copper foil that does not easily break or fracture. Additionally, a POSITA would have known that texture coefficients (which characterize the crystal structure) of copper foil and thus, the relative abundance or scarcity of these crystal planes, affect the suitability of a copper foil in a copper foil in a battery. Further, a POSITA would have known that the disclosed texture coefficient results in a preferred crystalline structure orientation. Further, the '014 Patent provides no indication of criticality or unexpected results associated with the claimed range of texture coefficients. For example, it was known that the texture coefficients affect adhesion between the copper foil and the active material and, consequently, the battery's charge/discharge cycle life. *See, e.g.*, Cheng, PRIOR_ART-00002211 at 2:30-35; 4:18-28; 10:27-34 ("when [] the texture coefficients of a (220) surface and a (311) surface of an electrolytic copper foil are higher, the crystalline grains of the electrolytic copper foil become larger and the roughness of the M side become higher" and disclosing that certain TC(220) values are associated with a "significant increase[e]" in elongation and a low matte-side roughness and that foils having the crystalline phase structure associated with the disclosed TC(220) values also have a "roughness difference between both sides" that is "extremely small [such that] it was thus not easy for the electrolytic copper foil to break or fracture."); Chou, PRIOR_ART-00000166 at [0049], Tables 1-2 (disclosing that texture coefficients are important parameters for determining foil

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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,	quality, and that the particular combinations of texture coefficients obtained for Chou's Examples 1-10 foils result in favorable roughness, mechanical, and nodule properties compared to foils having different texture coefficients). A POSITA would have had a reasonable expectation of success in modifying the primary reference to disclose this limitation. For example, it was known that texture coefficients can be manipulated by varying electrolysis conditions, chemistry, and manufacturing processes (*e.g.*, rolling and heating techniques). See, e.g., Cheng, PRIOR_ART-00000155 at 2:1-10 ("it is known that the crystalline phase of the electrolytic copper foil is changed by adding an organic additive"). The references in Appendix A, such as for example, Chou (A2), Dobashi (A3), Kim 887 (A12), Cheng (A1), Hirose 2009 (A7), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Yang** Yang, which is directed to electrolytic copper foils, shows that a POSITA would know that there is a relationship between the orientation of the grains and the electrolysis conditions. Thus, a POSITA would be motivated to evaluate the orientation: > Electrodeposits are known to have fine and randomly oriented grains in an initial stage and to assume their peculiar textures according to electrolysis conditions. Yang, PRIOR_ART-00000148 at PRIOR_ART-00000150. **Battey**

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	Battey, which directed to copper etching and printed circuit boards, (US Patent 4,695,348) renders this limitation obvious. As the '541 Patent File History explains: > Battey teaches a copper foil used in the manufacture of electronic circuit boards (col. 1, lines 8-17). The crystal orientation of the copper foil is described as being predominantly in the (111) and (200) orientations with relatively little (220) orientation in order to improve etching (col. 2, lines 1-10). Battey gives several examples of copper foils and X-ray diffraction analysis of the crystal structure, concluding that at least 70% of the orientation should be in the (111) and (200) planes, with no more than 15% in the (220) planes (col. 4, lines 1-35). Battey therefore recognizes that these crystal planes are important characteristics for a copper foil, and thus, the relative abundance or scarcity of these crystal planes, and by corollary, any measure of the intensity of these planes in the copper foil, are result effective variables. . . . One of ordinary skill in the art therefore would have been motivated, based on the teachings of Battey, to obtain the ideal amounts of these crystal planes in a copper foil through routine optimization and thereby arrive at the claimed ratios of texture coefficients (i.e., a ratio of crystal planes). '541 Patent File History, SKN-0001767 at SKN-0002321-322 (Office Action). In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at SKN-0002329 (Applicant-Initiated Interview Summary). A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a

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	reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[Claim 4] The electrolytic copper foil according to claim 1, wherein the electrolytic copper foil has a yield strength of 21 to 49 kgf/mm^2 measured at normal temperature.	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have had motivation to manufacture a copper foil with yield strength of 21-49 kgf/mm2 measured at normal temperature in order to prevent the generation of cracks, undue stress, and deformation. A POSITA could have manufactured a copper foil having a yield strength of 21-49 kgf/mm2 with a reasonable expectation of success using conventional manufacturing techniques and/or routine experimentation. For example, a POSITA would have known that the yield strength can be varied by varying the chemistry and electrodeposition characteristics (e.g., drum material, size, rotational speed, anode material, voltage, heat treatment, etc.). It also would have been obvious to use a yield strength within this range such that the foil could withstand forces during manufacturing and use. Further, the '014 Patent provides no indication of criticality or unexpected results associated with the claimed range of yield strength. The references in Appendix A, such as for example, Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Ezura (A4), Hirose 2009 (A7), Kim 541 (A10), Lee 980 (A14), Saito (A17), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Kobelco**

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	A POSITA would have understood that the yield strength measurements disclosed in Hanafusa are equivalent to the claimed range in light of Kobelco. Hanafusa states that the disclosed foil's "0.2% proof stress is 18 to 25 kgf/mm2." Kobelco, PRIOR_ART-00002610. Hanafusa, PRIOR_ART-00000463 at Abstract, cls 1, 6, [0009], [0013], [0026], [0034], [0045], [0060]. According to Kobelco, a POSITA would have understood that "proof stress" corresponds to a yield strength measured at normal temperature: > "[T]he stress required to produce an offset (plastic deformation) amount of 0.2 percent is generally used for the standard strength equivalent to the yield point, which is called '0.2% offset yield strength' or '0.2% proof stress.' Both yield point and 0.2% offset yield strength are often referred simply to as 'yield strength' or 'yield stress.'" Kobelco, PRIOR_ART-00002610. Thus, a POSITA would have understood that Hanafusa discloses a yield strength within the claimed range. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

U.S. 11,591,706 Secondary References

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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 and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to elements [1pre] of the '689 Patent ("An electrolytic copper foil, which includes a first surface and a second surface opposite the first surface, the electrolytic foil comprising") and [1pre] of the '014 Patent ("An electrolytic copper foil having a first surface and a second surface, the electrolytic copper foil comprising"). The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Kim 761 (A11), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Saito (A17), Suzuki (A21), Griesi (A23), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of

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	success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 ∑(I(hkl))/(I_0 (hkl)))	To the extent the preamble of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '541 Patent element 1[b] ("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 '014 Patent, Claim 2 ("shows a texture coefficient of a (220) plane, defined by Mathematical Expression 2 below, of 0.49 to 1.28"). A POSITA would have been motivated to have a copper foil with a texture coefficient of (220) plane of the electrolytic copper foil of 0.4 to 1.32 because they would know that optimizing a copper foil to have such a texture coefficient would result in increased elongation, low surface roughness, and a small surface roughness difference between the two surfaces. A POSITA would understand that these properties would result in a copper foil that does not easily break or fracture. Additionally, a POSITA would have known that texture coefficients (which characterize the crystal structure) of copper foil and thus, the relative abundance or scarcity of these crystal planes affect the suitability of a copper foil in a copper foil in a battery. Further, a POSITA would have known that the disclosed texture coefficient results in a preferred crystalline structure orientation. For example, it was known that the texture coefficients affect adhesion between the copper foil and the active material and, consequently, the battery's charge/discharge cycle life. *See, e.g.*, Cheng, PRIOR ART-00000155 at 2:30-35; 4:18-28; 10:27-34 ("when [] the texture coefficients

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	of a (220) surface and a (311) surface of an electrolytic copper foil are higher, the crystalline grains of the electrolytic copper foil become larger and the roughness of the M side become higher" and disclosing that certain TC(220) values are associated with a "significant increase[e]" in elongation and a low matte-side roughness and that foils having the crystalline phase structure associated with the disclosed TC(220) values also have a "roughness difference between both sides" that is "extremely small [such that] it was thus not easy for the electrolytic copper foil to break or fracture."); Chou, PRIOR_ART-00000166 at [0049], Tables 1-2 (disclosing that texture coefficients are important parameters for determining foil quality, and that the particular combinations of texture coefficients obtained for Chou's Examples 1-10 foils result in favorable roughness, mechanical, and nodule properties compared to foils having different texture coefficients). A POSITA would have had a reasonable expectation of success in modifying the primary reference to disclose this limitation. For example, it was known that texture coefficients can be manipulated by varying electrolysis conditions, chemistry, and manufacturing processes (*e.g.*, rolling and heating techniques).Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of texture coefficients. The references in Appendix A, such as for example, Chou (A2), Cheng (A1), Hirose 2009 (A7), Kim 541 (A10), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Yang** Yang, which is directed to electrolytic copper foils, shows that a POSITA would know that there is a relationship between the orientation of the grains and the electrolysis conditions. Thus, a POSITA would be motivated to evaluate the orientation:

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	Electrodeposits are known to have fine and randomly oriented grains in an initial stage and to assume their peculiar textures according to electrolysis conditions. Yang at PRIOR_ART-00000148 at PRIOR_ART-00000150. **Battey** Battey, which directed to copper etching and printed circuit boards, (US Patent 4,695,348) renders this limitation obvious. As the '541 Patent File History explains: Battey teaches a copper foil used in the manufacture of electronic circuit boards (col. 1, lines 8-17). The crystal orientation of the copper foil is described as being predominantly in the (111) and (200) orientations with relatively little (220) orientation in order to improve etching (col. 2, lines 1-10). Battey gives several examples of copper foils and X-ray diffraction analysis of the crystal structure, concluding that at least 70% of the orientation should be in the (111) and (200) planes, with no more than 15% in the (220) planes (col. 4, lines 1-35). Battey therefore recognizes that these crystal planes are important characteristics for a copper foil, and thus, the relative abundance or scarcity of these crystal planes, and by corollary, any measure of the intensity of these planes in the copper foil, are result effective variables. . . . One of ordinary skill in the art therefore would have been motivated, based on the teachings of Battey, to obtain the ideal amounts of these crystal planes in a copper foil through routine optimization and thereby arrive at the claimed ratios of texture coefficients (i.e., a ratio of crystal planes). '541 Patent File History, SKN-0001767 at SKN-0002321-322 (Office Action). In response to these assertions, Applicant did not rebut and instead initiated and interview wherein the Applicant and Examiner discussed a proposed amendment introducing the limitation "prevent wrinkle generation." *Id.* at SKN-0002329 (Applicant-Initiated Interview Summary).

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	A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[1b] a difference ($\|\Delta(Rz/Ra)\|$) 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 this limitation of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to have the disclosed Rz and Ra values, and a difference of less than 2.42, in order to prevent degradation, achieve desirable elongation and tensile strength, and avoid non-uniformity. *See, e.g.*, Cheng, PRIOR_ART-00000155 at 10:30-34 (disclosing that "a "small" "roughness difference between both sides" results in decreased breaking and fracturing during charging-discharging cycles, thus increasing battery life."); Sano, PRIOR_ART-00001729 at 1:44-52 (disclosing that "in recent years [] a thin electrodeposited copper foil having [] a small roughness difference between a shiny side and a matte [] has been demanded."); Shinozaki, PRIOR_ART-00001756 at [0055]-[0056], [0074], [0116], [0035], [0054] (disclosing that "a difference of a roughness between the roughnesses Rz of the front and back surfaces being within 3 μm or a difference of a roughness between the roughnesses Ra of the front and back surface being within 0.3 μm" are associated with improved battery performance). Further, the '689 Patent provides no indication of criticality or unexpected results associated with the claimed range of ($\|\Delta(Rz/Ra)\|$).

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	Indeed, the '014 Patent (which was filed before the '706 Patent) discloses that even as of its earlier filing date "Conventionally, it is reported that it is possible to increase force of adhesion between the copper foil and the negative electrode through control of surface roughness, such as Rz." '014 Patent at 1:53-56. The references in Appendix A, such as for example, Shinozaki (A19), Sano (A18), Kim 761 (A11), Cheng (A1), Hirose 2009 (A7), Kim 541 (A10), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Song** As the '706 prosecution history explains: > Song teaches electrolytic copper foils (abstract). The foil has a surfaced roughness Rz of the matte side from 1.2-1.7 pm (Paragraph 24), a Ra of the matte side being 0.18-0.3 pm (Paragraph 27), where the shiny side of the foil has a similar roughness to the matte side (Paragraph 30), and a ratio of the (220) peak to the (111) is 0.7-1.4 (Paragraph 35). Song teaches where the difference in roughness Rz between the matte and shiny sides is 0.5 pm or less and where uniformity in roughness prevents degradation when the foil is incorporated into a battery (Paragraphs 30-31). '706 Patent File History, SKN-0000946 at SKN-0001405. *See also*: > Song teaches where minimization of a difference in roughness between first and second surfaces of a copper foil is known to prevent degradation and one would have had a reasonable expectation of success. While Song does not specifically

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	teach the difference in terms of (|Δ(Rz/Ra)|), Song teaches where the roughness of the first and second surfaces are similar (Paragraph 30) and where this difference is desired to be minimized (Paragraphs 30-31) (i.e. ~zero) which overlaps the claimed range. *Id.* at SKN-0001406. Thus, while a POSITA may not have necessarily thought in terms of (|Δ(Rz/Ra)|), the overall motivation to minimize the difference between the roughness of first and second surfaces would result in an overlap of the claimed range. **Wolski** Wolski describes the desirability of having "the surface roughness Rz at the matte side of the untreated copper foil [be] the same or smaller than the surface roughness Rz at the shiny side of said untreated copper foil so that the surface treated copper foil after subjecting to bond enhancing treatment onto the matte side becomes more low-profiled one as compared with the conventional foil" and that having the disclosed Rz and Ra values result in "excellent" "elongation characteristics" and "high tensile strength." Wolski, PRIOR_ART-00002283 at 6:36-42; 9:28-29, 11:37-12:5, 12:16. Additionally, Wolski discloses Rz and Ra values that result in a (|Δ(Rz/Ra)|) within the claimed range. *See* Wolski at Table 2. **Tsai** Tsai (U.S. 9,365,942) teaches that a "low roughness at both sides and extremely small difference in roughness between both sides" is desirable for copper foils used for application in a lithium ion secondary battery. *See* Tsai, PRIOR_ART-00002255 at 3:14-15. **Marshall**

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	Additionally, it is known that a "higher Rz : Ra indicat[es] increased non-uniformity[.]" *See* Marshall, PRIOR_ART-00001538 at PRIOR_ART-00001539. Marshall teaches to use of copper foils in PCB, which a POSITA would know are applicable to copper foils for lithium ion batteries. See, e.g, Wolski, PRIOR_ART-00002283 at Abstract. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation of claim 1 is found to be limiting and not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. A POSITA would have been motivated to create a copper foil with similar roughnesses of both surfaces in terms of peak density in order to prevent degradation, achieve desirable elongation and tensile strength, improve adhesion, and avoid non-uniformity. A POSITA would have understood that PD is a surface roughness characteristic, and thus, as with Rz, a small difference between the two sides PD is desirable for capacity maintenance and to avoid deterioration. Additionally, a POSITA would have understood that there was demand in the industry for a copper foil with a small difference in roughness profiles between the two surfaces. *See, e.g.,* Sano, PRIOR_ART-00001729 at 1:44-52 ("in recent years [] a thin electrodeposited copper foil having [] a small roughness difference between a shiny side and a matte [] has been demanded."); Cheng, PRIOR_ART-00000155 at 10:30-34 (Cheng discloses that "a "small" "roughness difference

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	between both sides" results in decreased breaking and fracturing during charging-discharging cycles, thus increasing battery life.") Further, a POSITA would understand that PD is the same measurement as RPc according to ASME B46.1-2009, and would therefore understand that any disclosure of an RPc of 96 or less is also a disclosure of a PD of 96 or less. Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of (|ΔPD|). Thus, Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '090 Patent elements 1[c] ("wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100…") claim 2 (" wherein a difference in peak count roughness Rpc between the first and second surfaces is 60 or less"); '706 Patent element 1[b]. The references in Appendix A, such as for example, Chou (A2), Sano (A18), Cheng (A1), Dobashi (A3), Kim 761 (A11), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Tsai** Tsai (U.S. 9,365,942) teaches that a "low roughness at both sides and extremely small difference in roughness between both sides" is desirable for electrolytic copper foils "particularly suitable for applications in a lithium ion secondary battery". *See* Tsai, PRIOR_ART-00002255 at Abstract, 3:14-15. **ASME B46.1-2009** The 2009 ASME standard describes "Rpc" as "peak density," thus suggesting that Rpc and PD are both used to describe the same measurement in the industry. SKN-0006603. A POSITA would therefore understand that Rpc and PD describe the same surface characteristic.

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	A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '706 Patent, Claim 1[b] ("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 been motivated to make an electrolytic copper foil wherein the second surface is an M surface, and the Rz/Ra at the second surface is 4.2 to 9.0 for the reasons stated above and have a reasonable likelihood of success in achieving a copper foil wherein the Rz/Ra of the second surface is within the claimed range. Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of Rz/Ra for the M surface. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 887 (A12), Hanafusa (A5), Kim 761 (A11), Iwama (A8), Lee 980 (A14), Saito (A17), Griesi (A23), Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional

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	motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Wolski** Wolski discloses Rz and Ra values that result in a Rz/Ra at the M surface within the claimed range. *See* Wolski, PRIOR_ART-00002283 at Table 2. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above in '706 Patent, Claim 1[b] ("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 been motivated to make an electrolytic copper foil wherein the first surface is an S surface, and the Rz/Ra at the second surface is 5.1 to 6.8 for the reasons stated above and have a reasonable likelihood of success in achieving a copper foil wherein the Rz/Ra of

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	the first surface is within the claimed range. Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of Rz/Ra for the S surface. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 887 (A12), Hanafusa (A5), Kim 761 (A11), Hirose 2009 (A7), Iwama (A8), Lee 980 (A14), Saito (A17), Griesi (A23), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Wolski** Additionally, Wolski discloses Rz and Ra values that result in a Rz/Ra at the S surface within the claimed range. *See* Wolski, PRIOR_ART-00002283 at Table 2. TABLE 2 Surface roughness and mechanical characteristics of untreated copper foil Matte side roughness (μm): R_z = 1.3, R_a = 0.30 Shiny side roughness (μm): R_z = 2.0, R_a = 0.40 Room temperature (25° C.): Tensile strength (kgf/mm²) = 37.2; Elongation (%) = 18.1 High temperature (180° C.): Tensile strength (kgf/mm²) = 18.6; Elongation (%) = 26.7 Example 2: 2.1, 0.32, 2.1, 0.35, 33.6, 11.7, 19.5, 19.7 Example 3: 1.1, 0.20, 1.8, 0.35, 35.3, 19.8, 19.0, 24.6 Example 4: 0.6, 0.14, 1.4, 0.23, 33.8, 14.4, 18.7, 25.8 Comparative example 1: 3.3, 0.40, 2.0, 0.37, 36.8, 9.0, 20.3, 8.0 Comparative example 2: 4.8, 0.70, 2.1, 0.32, 33.7, 9.5, 20.5, 2.0

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	A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to '541 Patent element 1[c] ("tensile strength of 30 to 40 kgf/mm2"), '090 Patent element 4[b] ("tensile strength of 30 to 60 kgf/mm2"). A POSITA would have had motivation to manufacture a copper foil with a tensile strength of 30 – 65 kgf/mm2 because that range has been commercially produced and used since the 1900s. *See, e.g.*, Bennett (discussed below). Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of tensile strength at room temperature. A POSITA would know that a tensile strength of 30 – 65 kgf/mm2 is achievable through rolling copper foil, and that the tensile strength can be increased by increasing rotation speed of the drum. Thus, a POSITA would find it obvious to have a range of 30 – 65 kgf/mm2 and understand how to increase the tensile strength by increasing the rolling speed. The references below disclose the claimed range of 30 to 65 kgf/mm2.

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	The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Kim 761 (A11), Cheng (A1), Ezura (A4), Hirose 2009 (A7), Kim 541 (A10), Lai (A13), Lee 980 (A14), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Song** The '706 Patent file history additionally notes: > Song teaches where the tensile strength is 20 kgf/mm^2 or more at room temperature (Paragraph 23). '706 Patent File History, SKN-0000946 at SKN-0001283-284 (Non-Final Rejection). **Matsuda** As the '541 Patent File History explains well before the filing of the '706 Patent Application that the tensile strength should be at least 30 kgf.mm2: > Matsuda teaches a copper foil suitable for use in collecting materials on lithium ion batteries (¶ 52). **These copper foils ideally have a tensile strength of more than 30 kg-f/mm2** and an elongation of at least 8% (¶ 51). It would have been obvious at the time of invention for one of ordinary skill in the art to create the copper foil of Hirose having the properties as taught by Matsuda because **Matsuda teaches these mechanical properties are ideal for various electronic applications of copper foil (¶ 51).** '541 Patent File History, SKN-0003271 at SKN-0002320.

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	Bennett Bennett discloses the following: > The next important commercial application of this principle was the Elmore process. In this, the cathode was a mandrel, rotating vertically, over which agate burnishers. rotated, keeping the deposited copper tubes smooth, and of constant thickness throughout. This process is used commercially in Europe at present in the manufacture of seamless copper tubes. The current density used is no more than 30 amperes per square foot (3.3 A. per sq. dm.)°. The copper thus obtained has a tensile strength of from 36,000 to 50,000 pounds per square inch (25 to 35 kg. per sq. mm.) depending, it is stated, on the speed of rotation. Bennet, PRIOR_ART-00000126 at PRIOR_ART-00000126. **Wolski** Wolski discloses that a high tensile strength is desirable for "dimensional stability." *See* Wolski, PRIOR_ART-00002283 at 2:34-35. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.

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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.	To the extent this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to '541 Patent Claim 3 ("elongation of 3 to 20%") and '689 Patent Claim 2 ("elongation of 3% or more at room temperature"). A POSITA would have been motivated to have a copper foil with an elongation of 3% or more because such an elongation is an ideal mechanical property for the copper foil, and an elongation that is too low results in stress applied and a drop in the charge/discharge cycle lives. A POSITA also would know that more than 3% elongation would be ideal for the copper foil because a higher elongation means that the copper foil can undergo greater amounts of stress when pulled without breaking. Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of elongation. The references in Appendix A, such as for example, Chou (A2), Shinozaki (A19), Sano (A18), Kim 887 (A12), Hara (A6), Hanafusa (A5), Cheng (A1), Hirose 2009 (A7), Iwama (A8), Kato (A9), Kim 541 (A10), Lee 980 (A14), Saito (A17), and Suzuki (A21), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. **Oguro** As the prosecution history of the '689 Patent explains, Iwama and Ogura already disclosed an elongation of 3% or more:

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	Iwama does not explicitly teach an elongation of 3% or more at room temperature. However, Oguro teaches an elongation rate of 3.5% or more at 25°C, which teaches or at least suggests an elongation of 3% or more at room temperature. (Oguro in 0193) The skilled artisan would find obvious to modify Iwama with an elongation of 3% or more at room temperature. The motivation for such a modification is to the elongation of the electrolytic foil directly affecting adhesion of the active material. (Oguro in 0194) '689 Patent File History, SKN-0000001 at SKN-0000347 (Non-Final Office Action). **Matsuda** Copper foils require a balance of tensile strength and elongation. *See, e.g.*, Matsuda, PRIOR_ART-00001544 at [0012] ("the copper foil expansion/contraction behavior cannot follow the current collector expansion/ contraction, whereby a phenomenon of the breakage thereof occurs. Therefore, mechanical properties of copper foil as current collecting material, for bearing the repeated expansion/contraction behavior, are required to have a favorable balance between the tensile strength and elongation.") **Wolski** Wolski describes the desirability of a high elongation. When electrolysis current density is suppressed to a lower value, as compared with an electrodeposited foil prepared with high current density, roughness of the matte side is lowered and elongation and tensile strength are improved, but lowering in productivity is not preferred from an economical view. Wolski, PRIOR_ART-00002283 at 5:55-65. *See also id.* at 2:36-59. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading,

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	which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.
[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 this limitation is found not to be disclosed by any reference in Appendix A, a POSITA would have found it obvious to modify the reference to include this limitation in light of the other reference in Appendix A, the references cited below, and further in light of the knowledge of a POSITA. Defendants incorporate by reference the secondary references, evidence and arguments discussed above with respect to '541 Patent element 1[b] ("weight deviation of 3% or less"), '689 Patent element and 1[f] ("weight deviation of 5% or less"). A POSITA would have been motivated to have a copper foil with a weight deviation of 5% or less because having a low weight deviation equates to uniformity, and having uniformity is desirable to avoid the development of wrinkles and other defects. Indeed, the '706 Patent acknowledges in its "Background of the Invention" that "[c]onventionally, the range of roughness of a copper foil is controlled to be uniform in order to reduce the incidence of defects of the copper foil products." '706 Patent, SKN-0003260 at 1:45-47; *see also*, '541 Patent, SKN-0003271 at 2:5-10; 4:26-29 (stating that when parameters including "weight deviation" are optimized, "the generation of wrinkles at a surface of the copper foil" can be "effectively decrease[d]" and that of having a low weight deviation, e.g., "3% or less" in order to avoid "property deviations [] which may increase the number of wrinkles."). Further, the '706 Patent provides no indication of criticality or unexpected results associated with the claimed range of weight deviation.

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	The references in Appendix A, such as for example, Chou (A2), Dobashi (A3), Sano (A18), Kim 887 (A12), Hara (A6), Kim 541 (A10), Lai (A13), Otsuka 944 (A15), Otsuka 006 (A16), Suzuki (A21), and Tani (A20), which have been separately charted and are incorporated by reference herein, as well as the additional references cited below, support and describe these and additional motivations to include this limitation and show that it was conventional, well-known and could have been implemented by a POSITA with a reasonable expectation of success. A POSITA would have been motivated to make the combinations, and would have had a reasonable expectation of success, for the reasons described above and in the Cover Pleading, which is incorporated by reference herein. For example, all of the references relate to batteries and/or copper foils and are in the same field of endeavor. Further, one of skill in the art would find the combination obvious to try, due at least to the similarity of the technical teachings of the art. As another example, one of skill in the art would find that the teachings could be predictably interchanged by, for example, simple substitution, at least because of the predictability of the art and the known interchangeability of the various elements. As another example, one of skill in the art would be motivated to combine the references, and would have a reasonable expectation of success in doing so, at least because the references use known variations of existing technology to solve routine and well understood problems in predictable ways.