

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SOLUS ADVANCED MATERIALS CO., LTD.,
Petitioner

v.

SK NEXILIS CO., LTD.,
Patent Owner

Case IPR2024-01461
U.S. Patent No. 10,811,689

**PATENT OWNER PRELIMINARY RESPONSE
UNDER 37 C.F.R. § 42.107(a)**

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U.S. Patent and Trademark Office
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PATENT OWNER'S EXHIBIT LIST

Exhibit No.	Description
2001	Defendants' Motion to Stay, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Oct. 24, 2024)
2002	Plaintiff's Opposition to Defendants' Motion to Stay, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Nov. 7, 2024)
2003	Defendants' Reply in Support of Motion to Stay, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Nov. 14, 2024)
2004	Plaintiff's Sur-Reply in Opposition to Defendants' Motion to Stay, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Nov. 21, 2024)
2005	Amended Docket Control Order, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Jan. 2, 2025)
2006	Federal Court Management Statistics (Sept. 30, 2024)
2007	Complaint, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Nov. 21, 2023)
2008	Results charted from DocketNavigator.com, run on January 5, 2025, for Success of Motion to Transfer Venue for Convenience Decided by Judge Rodney Gilstrap
2009	Order Granting Service Waiver, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Feb. 23, 2024)
2010	Defendants' P.R. 3-3 Invalidity Contentions, <i>SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.</i> , No. 2:23-cv-00539 (E.D. Tex. Aug. 23, 2024) (including Apps. A12, A19, A23)
2011	Appendix B – Secondary References Chart

Exhibit No.	Description
2012	<i>Intentionally left blank</i>
2013	Overview of U.S. Pat. Appl. Publ. No. 2013/0108922 to Shinozaki <i>et al.</i> , accessed January 5, 2025 at: https://worldwide.espacenet.com/patent/search/family/045402087/publication/US2013108922A1?q=US2013108922A1
2014	Overview of Korean Pat. Appl. Publ. No. KR20120003485A to Toshio <i>et al.</i> , accessed January 5, 2025 at: https://worldwide.espacenet.com/patent/search/family/043050177/publication/KR20120003485A?q=KR 2012%2F0003485
2015	Overview of U.S. Pat. Appl. Publ. No. 2013/0108887 to Kim <i>et al.</i> , accessed January 5, 2025 at: https://patentcenter.uspto.gov/applications/13722585/continuity?application=
2016	<i>Intentionally left blank</i>
2017	Average Roughness Basics, Michigan Metrology, LLC (2025), accessed at: https://michmet.com/average-roughness-basics/
2018	Khatibi (Weiss) <i>et al.</i> , “Characterization of mechanical and thermal properties of thin Cu foil and wires,” Sensors and Actuators A 99 (Apr., 2002).

I. Introduction

U.S. Patent No. 10,811,689 (“the ’689 patent”), claims innovative, non-obvious improvements to electrolytic copper foil for secondary batteries. By manipulating material and chemical properties within the foil and during the foil production process, the inventors discovered that certain unexpected and desirable performance characteristics could be achieved. In particular, as embodied in the claim limitations, the inventors discovered that precise balancing of copper foil thermal expansion characteristics, tensile strength, weight, peak count (Pc), and surface roughness (Rz) reduces deleterious foil curling and wrinkling to produce an easily-handleable foil with desired operating characteristics. SK nexilis, Co., Ltd. (“Patent Owner”), the ’689 patent’s assignee, has long remained a leader in the battery copper foil industry, with significant investment in the research and development of battery copper foil products.

Solus Advanced Materials Co., LTD’s (“Solus or Petitioner”) Petition for review of claims 1-10 should be denied because it fails to demonstrate a reasonable likelihood that any challenged claim will be found unpatentable. Not only are claim elements missing in the prior art, but Petitioner failed to demonstrate a motivation to combine or reasonable expectation of success in this unpredictable art. But the Board need not even reach the merits, as the facts and circumstances here warrant denying institution under Section 314(a) when applying the *Fintiv*

factors.

The *Fintiv* factors strongly support discretionary denial. Notably, the co-pending litigation trial date is nearly six months before the FWD deadline, significant investment in the co-pending litigation has occurred and will continue to occur prior to institution, the Petition was filed ten months after the complaint was filed, and the Petition's merits are very weak—failing to even address all the claim elements and appropriately consider the interplay of the claim limitations related to the foil material characteristics. Section 325(d) also allows for the Board to deny the Petition here, where Petitioner (1) relies on art and arguments that are the same and/or cumulative of art and arguments previously before the Office—including a reference in *both grounds* that was considered during prosecution—and (2) fails to demonstrate or even allege that the Office erred in a manner material to the patentability of challenged claims.

On the merits, the Petition and applied art have multiple missing elements. The Petition does not demonstrate that any combination of references discloses the specific measurement conditions and characteristics of claim elements [1d] and [1e] (and [6c]/[10b]). None of the references disclose the claimed peak count (Pc) limitations. And Petitioner's attempt to derive Pc from other surface roughness measures (e.g., Rsm/Sm, Ra, Rz/Rzjis) is unavailing. These measures do not inform the height of individual peaks, without which one cannot determine the

peak count. Additionally, the Petition fails to demonstrate that any combination renders obvious the peak count (Pc) and surface roughness (Rz) limitations that are required for *each* of the first and second surfaces. The Petition addresses these limitations for a first surface and then summarily concludes (incorrectly) that they would have been obvious for a second surface.

In addition to the missing claim elements, the Petition fails to meet its burden to demonstrate that a person of ordinary skill in the art would have been motivated to combine the references or had a reasonable expectation of success of doing so—specifically with respect to Khatibi, which is used in both Grounds. The claims and detailed description manipulate material science and chemical properties to achieve desired characteristics. The conclusory statements in the Petition alleging a reasonable expectation of success do not meet the Petition’s burden in unpredictable arts, such as here. Furthermore, the Petition simply ignores the numerous statements in the ’689 patent and the references that highlight the interrelationship and unpredictable interactions associated with adjusting the various material characteristics recited in the claims.

In sum, the Board should apply its discretion to deny institution under *Fintiv* and/or Section 325(d). Alternatively, the Board must deny institution on the merits, as the Petition is fundamentally deficient—failing to demonstrate that multiple claim elements are disclosed by the references, and failing to meet its most basic

burden to demonstrate a motivation and reasonable expectation of success when combining references.

II. Person of Ordinary Skill in the Art

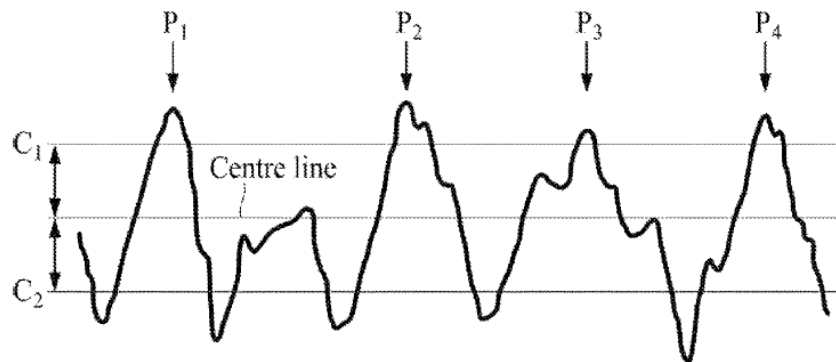
For purposes of this Preliminary Response, Patent Owner applies Petitioner's level of skill for a person of ordinary skill in the art (POSA). Pet., 3.

III. Claim Construction

Patent Owner reserves the right to contest Petitioner's implicit or explicit constructions during the proceeding.

Under *Phillips*, the term “peak count (Pc)” in the claims must be read in light of the '689 patent's specification. Particularly, the '689 patent explains peak count (Pc) with reference to Figure 2:

FIG. 2



EX1001, FIG. 2.

The '689 patent explains that:

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 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.”

EX1001, 7:43-59. Accordingly, the claims of the '689 patent apply this description when evaluating the meaning of “peak count (Pc).” And Petitioner applies this description throughout the Petition. *See, e.g.*, Pet., 20-21, 24, 28.

IV. The '689 Patent

A. Overview of the '689 Patent and Claims

The '689 patent is directed to electrolytic copper foils with “improved handleability and capable of securing a secondary battery having a high durability.” EX1001, Abstract, 2:12-22. The specification describes “an electrolytic copper foil capable of preventing problems caused by limitations and

disadvantages of the related art, an electrode including the same, a secondary battery including the same, and a method of manufacturing the same.” EX1001, 2:7-11. The invention balances improved handleability of the copper foil and durability improvements of its use in a secondary battery. EX1001, Abstract, 2:12-22.

As Petitioner acknowledges, the ’689 patent describes and claims “*specific ranges* of ‘coefficient of thermal expansion, ‘tensile strength,’ and ‘weight deviation’ of the electrolytic copper foil, and *specific ranges* of ‘peak count’ and surface roughness (Rz)’” of the first and second surfaces. Pet., 2 (citing EX1001, Abstract, 2:27-54).¹ The specification explains that due to the claimed features, “since curling and/or wrinkling of an electrolytic copper foil during a roll-to-roll process can be prevented, a reduction of productivity due to repeatedly stopping and re-starting a facility can be prevented and manufacturing costs can be reduced.” EX1001, 13:23-31. And “since breakage of the electrolytic copper foil can be prevented when charging and discharging a lithium secondary battery, durability of the secondary battery can be significantly improved.” EX1001, 13:23-31.

Independent claim 1 is directed to an electrolytic copper foil; independent

¹ Emphasis added unless otherwise noted.

claim 6 is directed to a secondary battery electrode comprising an electrolytic copper foil with the same features as claim 1; and independent claim 10 is directed to a secondary battery, also comprising an electrolytic copper foil with the same features as claim 1. The '689 patent's claims includes specific coefficient of thermal expansion (CTE) features claimed in [1d], [6c], and [10b], tensile strength features claimed in [1e], [6c], and [10b], and peak count (Pc) and surface roughness (Rz) features claimed in [1g], [6c], and [10b]. These specifically claimed features are shown below:

[1d]	wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30° C. to 190° C. at a speed of 5° C./min, ranges from 16 to 22 $\mu\text{m}/(\text{m} \cdot ^\circ \text{C}.)$,
[1e]	a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190° C. for 1 hour, ranges from 21 to 36 kgf/mm ² ,
[1g]	a peak count (Pc) of each of the first and second surfaces of the electrolytic copper foil ranges from 3 to 92, and

B. Prosecution History of the '689 Patent

During prosecution, Applicant provided approximately *eight pages* of argument related to the Office's obviousness rationale for the peak count Pc features of [1g] (and by extension [6c]/[10b]). *See* EX1002, 29-34, 57-58. Applicant observed that none of the art applied in the rejections disclosed the

claimed peak count Pc features and that none of the art recognized Pc as a result-effective variable. *See* EX1002, 29-34. Applicant also explained that the applied art's Rz (surface roughness) parameters are entirely different from Pc (peak count) because their measurements are wholly unrelated and one cannot be used to obtain the other. *See* EX1002, 31-33.

An Examiner's Amendment added the Rz features of [1h] (and [6c]/[10b]), and noted that "the prior art of record does not teach or suggest the instant invention regarding an electrolytic copper foil having, for each of its first and second surfaces, a peak count ranging from 3 to 92 and a surface roughness Rz of 3.5 μm or less." EX1002, 14. The '689 patent then proceeded to issuance.

Applicant did not waive any arguments that the claims were separately allowable for different reasons, and the addition by the Examiner of an Rz parameter further suggests that the Office recognized that Pc cannot be derived from an Rz value.

V. The Board should use its discretion under Section 314(a) to deny the Petition in view of the parallel litigation.

The facts here fit squarely within the type of cases the Board uses its discretion to deny petitions under § 314(a). In *Apple Inc. v. Fintiv, Inc.*, the Board articulated six nonexclusive factors for determining whether to institute an AIA post-grant proceeding where there is parallel district-court litigation. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020) ("*Fintiv*"). On June 21, 2022, Director Vidal issued a Memorandum re: Interim Procedure for

Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (“*Fintiv* Memo”) clarifying the procedure that the Board should follow when evaluating the six *Fintiv* factors. Here, the Board should exercise its discretion to deny the Petition because (1) *Fintiv* factors two through five support discretionary denial; and (2) the Petition does not provide a compelling, meritorious challenge (*Fintiv* factor six).

Fintiv factor one: An opposed motion to stay has been filed in the parallel litigation. EX2001-2004. But this motion is still pending, and the Board should not speculate whether the court would grant a stay in the event this proceeding were instituted. Factor one, therefore, is neutral. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (P.T.A.B. May 13, 2020) (informative) (“*Fintiv II*”) (holding the Board should “decline to infer ... how the District Court would rule should a stay be requested by the parties.”); *see also Fusion Orthopedics, LLC v. Extremity Medical, LLC*, IPR2023-00894, Paper 15 at 28-29 (P.T.A.B. Nov. 17, 2023) (“[W]e decline to speculate whether the pending motion to stay might be successful.”).

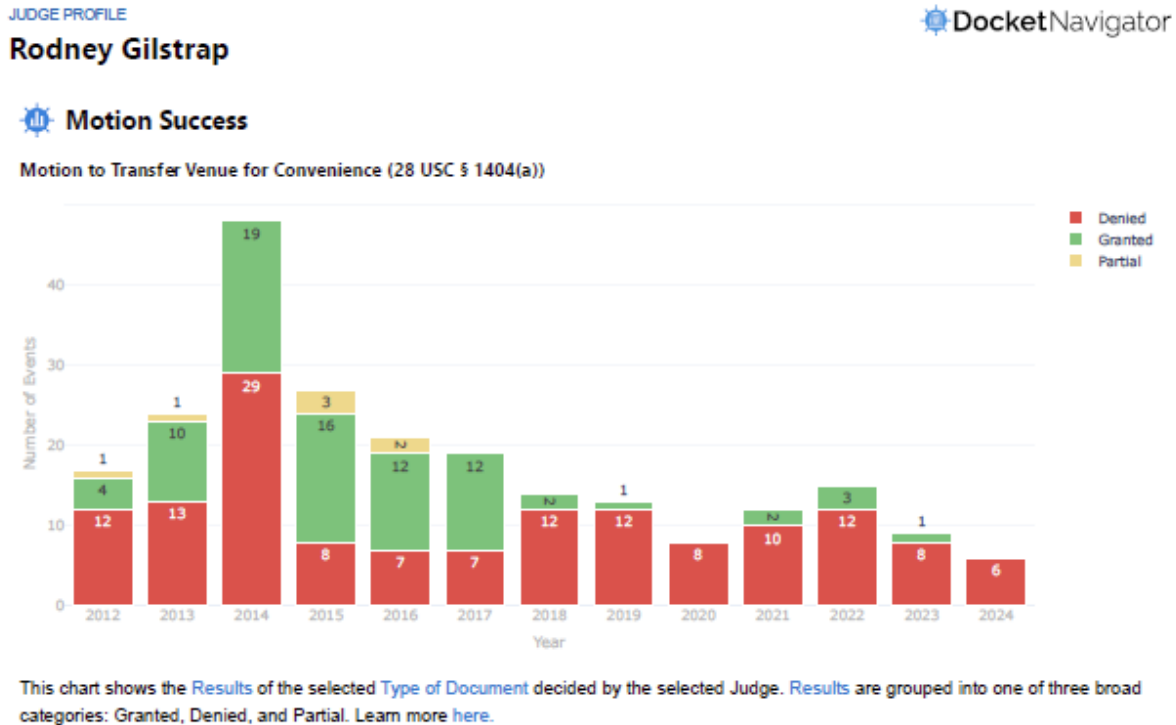
Fintiv factor two: Factor two weighs heavily in favor of discretionary denial. The projected statutory deadline for issuing a Final Written Decision (FWD) in this IPR is April 24, 2026. Jury selection in the parallel litigation is scheduled to begin November 3, 2025, nearly six months before the projected

FWD deadline. EX2005, 1. The *Fintiv* Memo also authorizes panels to “consider the median time from filing to disposition of the civil trial for the district in which the parallel litigation resides” as reported on the uscourts.gov website. *Fintiv* Memo, 3 n.4. The median time-to-trial for civil actions in the Eastern District of Texas is 21.9 months. EX2006, 35. The complaint in the parallel litigation was filed November 21, 2023. EX2007. Applying the median time-to-trial, the estimated trial date would be in mid-September 2025, which is even earlier than the scheduled trial date.

Petitioner further asserts that a pending motion to transfer “will help ensure that the FWD outpaces any trial date.” Pet., 76. But, like a motion for stay, a judge determines whether to grant a motion to transfer “based on the facts of each specific case as presented in the briefs by the parties.” *See Fintiv II* at 12. The Board should not speculate on how the court will rule on the pending motion to transfer. *See id.*; *Samsung Display Co., Ltd. v. Pictiva Displays Int’l Ltd.*, IPR2024-00855, Paper 12 at 8-9 (P.T.A.B. Nov. 19, 2024)² (declining to speculate

² Acting Director Brent recently issued a *sua sponte* Director Review decision modifying this decision. *Samsung Display Co., Ltd. v. Pictiva Displays Int’l Ltd.*, IPR2024-00855, Paper 13 (Acting Director Brent Jan. 10, 2025). That decision addresses a specific issue related to factor 6, not relevant here, and affirms the

how the district court might rule on pending motions). Even if the Board was inclined to speculate, according to Docket Navigator statistics, since 2018 Judge Gilstrap rarely grants such transfer motions:



EX2008.

Under the current facts, trial in EDTX is scheduled to begin nearly six months before the FWD deadline, and thus factor two weighs heavily in favor of denying institution. *See AT&T Services Inc. v. ASUS Tech. Licensing Inc.*, IPR2024-00992, Paper 14 at 10-11 (P.T.A.B. Dec. 16, 2024) (denying institution;

panel's exercise of discretion to deny institution.

finding “the second factor weighs substantially in favor of discretionary denial” where trial was scheduled “four to five months prior” to FWD deadline); *Ericsson Inc. v. Active Wireless Techs. LLC*, IPR2024-00886, Paper 8 at 8-9 (P.T.A.B. Nov. 12, 2024) (denying institution; finding factor 2 weighs in favor of denial with trial date approximately 4 months prior to FWD deadline).

Fintiv factor three: Factor three weighs in favor of denying institution.

Here, the Board “consider[s] the amount and type of work already completed in the parallel litigation by the court and the parties *at the time of the institution decision.*” *Fintiv*, 9. The deadline for issuing a Decision on Institution (DI) in this IPR is April 24, 2025. The parties have already exchanged invalidity and infringement contentions and are engaged in fact discovery, with each party already producing over 5,000 documents, and corporate depositions are ongoing. By the April 24, 2025 DI deadline, the parties will have completed claim construction briefing, the Claim Construction Hearing will be imminent (on May 14, 2025), and the parties will be nearing the end of fact discovery. EX2005, 4-5; EX1038, 3-5.

Petitioner contends “the EDTX litigation is still in its early stages and the parties and court have yet to expend significant resources on invalidity,” Pet., 76, but Petitioner considers the state of the parallel litigation at the time the Petition was filed, not at the time of the DI, and does not even consider the then-current

proposed case schedule, which Petitioner filed as Exhibit 1038.³ Nor was Petitioner diligent in filing the Petition, as it alleges. *See* Pet., 76. The Petition was filed September 20, 2024, which was ten months after the complaint was filed, and seven months after the February 23, 2024 order noting Petitioner’s waiver of foreign service. EX2009. Petitioner’s only argument of diligence is that it filed the Petition “months ahead of the one-year time bar.” Pet. 76. But this alone is insufficient. *See Ericsson Inc.*, IPR2024-00886, Paper 8 at 9-10 (denying institution; determining that merely “filing Petition ‘in advance of the statutory deadline’” alone does not weigh in favor of institution, noting “Petitioner [did] not explain how it was diligent or even identify the time period during which it contends it was diligent.”).

Because the parties and the court will have expended significant resources by the April 24, 2025 DI deadline and because Petitioner was not diligent in filing the Petition, factor three weighs in favor of denying institution.

Fintiv factor four: Factor four weighs in favor of denying institution.

³ The current schedule, issued January 2, 2025, and filed as Exhibit 2005, includes only minor differences from the June 12, 2024 proposed schedule Petitioner submitted with the Petition (EX1038). Petitioner should not be granted additional briefing to address any alleged updates to the schedule since filing the Petition.

“*Fintiv* factor four looks at the overlap between the issues raised in the IPR petition and in the parallel proceeding in order to evaluate ‘concerns of inefficiency and the possibility of conflicting decisions.’” *Fintiv* Memo, 7; *Fintiv*, 12. Here, there is significant overlap between the invalidity issues: the Petition challenges the validity of the claims of the ’689 patent based on various combinations of Shinozaki, Khatibi, Toshio, Kim, and Griesi, Pet., 1; in the parallel litigation, Petitioner challenges the validity of claims 1-5 using each of these references⁴ in addition to others. EX2010, 21-23, 52-73, Apps. A12, A19, A23.

Petitioner’s stipulation—to “not seek resolution in the district court of the same grounds presented in [the] Petition”—is not a *Sotera* stipulation and does not allay the concerns undergirding factor four. In fact, Petitioner’s stipulation is essentially meaningless. Most of Petitioner’s asserted references, including the primary reference in each ground, has at least one counterpart or related patent/publication that is not included in the stipulation. Shinozaki was also published as WIPO publication WO 2012/002380. EX2013. Toshio was also published as WIPO publication WO 2010/128681. EX2014. Kim was also published as US Patent No. 8,349,518. EX2015. But even if Petitioner stipulated

⁴ Toshio is cited in the discussion. EX2010, 48, 50; EX2011, 3, 67-68, 86-69. Khatibi is included as an additional secondary reference. EX2011, 1, 71-73.

not to use these related references, that still does not prevent Petitioner from using other references that have cumulative teachings.

Accordingly, because there is significant overlap in validity issues and Petitioner's stipulation does nothing to reduce this overlap, factor four weighs in favor in denying institution.

Fintiv factor five: Factor five weighs in favor of denying institution because, as Petitioner acknowledges, "parties in the parallel litigation are the same." Pet., 76; *Fintiv II*, 15 ("Because the petitioner and the defendant in the parallel proceeding are the same party, this factor weighs in favor of discretionary denial."); *see also Ericsson Inc.*, IPR2024-00886, Paper 8 at 13-14 (factor five weighs in favor of denial where the district court is likely to precede the FWD).

Fintiv factor six: The *Fintiv* Memo explains that "[c]ompelling, meritorious challenges are those in which the evidence, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence." *Fintiv* Memo, 4. Petitioner provides nothing more than a bare statement that "the Petition presents a compelling case of invalidity." Pet., 76. But, as explained in the arguments below, the Petition fails to demonstrate: 1) any motivation to combine Khatibi with either primary reference, 2) that any of the combinations disclose the specific CTE and tensile strength measurement conditions of the independent claims, 3) why the claimed features would be

applied on both sides of the foil, and 4) that peak count (Pc) is disclosed or suggested by any combination. *See* Section VII. Petitioner’s expert largely repeats the Petition verbatim without providing additional analysis or corroborating evidence. *Id.*; *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (P.T.A.B. Aug. 24, 2022). Therefore, factor six favors denying institution. *Fintiv*, 15.

* * *

At bottom, the scheduled trial date is nearly six months before the projected FWD, the parties will have invested significant resources in the district court, Petitioner’s narrow stipulation does nothing to alleviate concerns of inefficiency or the possibility of conflicting decisions, and the merits are not compelling. The Board should exercise its discretion to deny the Petition in view of the parallel litigation.

VI. The Board should exercise its discretion to deny the Petition under Section 325(d).

The Board has discretion to deny review where “the same or substantially the same prior art or arguments previously were presented to the Office.” 35

U.S.C. § 325(d). The Board’s two-part framework considers:

- (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and

- (2) if either condition of [the] first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH, IPR2019-01469, Paper 6 at 8 (P.T.A.B. Feb. 13, 2020) (precedential March 24, 2020). Here, if the first part of the framework is satisfied, the second is, too—Petitioner does not even attempt to allege that the Office erred in a manner material to the patentability of the challenged claims. *See, e.g.*, Pet., 3, 77.

The Board considers the *Becton, Dickinson* factors when applying the framework. *Advanced Bionics*, IPR2019-01469, Paper 6 at 9. *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17-18 (P.T.A.B. Dec. 15, 2017) (informative). The facts here support denial under Section 325(d), at least because Petitioner relies on art and arguments that are either the same or cumulative of art and arguments that were expressly considered and overcome during prosecution.

Petitioner states that “[t]his Petition presents new prior art and arguments against the Challenged Claims for which the file history contains no indication that the Office ever previously considered in connection with the ’689 Patent.” Pet., 77. But this is incorrect. Japanese counterpart (JP 2012-022939) to Kim (primary reference in Ground 2, secondary reference in Ground 1), was previously before the Office. EX1001, 2 (citing JP 2012-022939 on its face); EX1002, 431 (IDS

citing JP 2012-022939), 65 (Examiner stating each IDS was “considered by the examiner”). *See, e.g., Siemens Mobility, Inc. et al. v. Metrom Rail, LLC*, IPR2024-00947, Paper 12 at 12-13, 18-19 (P.T.A.B. Nov. 19, 2024) (denying institution where references cited on an IDS were considered by the Examiner during original prosecution, other references or arguments presented were substantially similar as those in the original prosecution, and Petitioner failed to demonstrate material error by the Examiner).

Accordingly, Kim, as relied on by Petitioner, satisfies *Becton, Dickinson* factors (a), (b), and (d), under the first prong of the framework. Petitioner does not address factors (c) or (e), or even allege that the Office erred in its evaluation the asserted prior art, which is required for the second prong. Regarding factor (f), no amount of faulty assumptions and pages of incorrect math from Petitioner’s declarant can constitute new facts or evidence to warrant reconsideration of the prior art or arguments.

Because Petitioner (1) relies on art and arguments that are the same and/or cumulative of art and arguments previously before the Office—including a reference in *both grounds* that was considered during prosecution—and (2) fails to demonstrate or even allege that the Office erred in a manner material to the patentability of challenged claims, *Advanced Bionics* counsels that the Board should exercise its discretion and deny the Petition under Section 325(d).

VII. Petitioner fails to establish a reasonable likelihood of prevailing on any challenged claim.

Petitioner falls short of carrying its burden at least because the Petition fails to demonstrate: 1) any motivation to combine Khatibi with either primary reference, 2) that either Ground discloses the specific CTE and tensile strength measurement conditions of the independent claims, 3) that the claimed peak count (Pc) is disclosed or suggested by any combination, and 4) why the claimed features would be applied on both sides of the foil.

In an IPR, “the burden of proving a proposition of unpatentability” is borne by (and remains at all times with) the petitioner. 35 U.S.C. §§ 314(a), 316(e); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016). To satisfy its burden, a petitioner must “articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness”—“mere conclusory statements” will not suffice. *Magnum Oil*, 829 F.3d at 1380. Indeed, “[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (quoting 35 U.S.C. § 312(a)(3)); *see also Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1371 (Fed. Cir. 2023) (a party’s burden “cannot be met simply by throwing mountains of evidence at the Board without explanation or identification of the relevant portions

of that evidence.”).

“An obviousness determination requires finding that [a Skilled Artisan] would have been motivated to combine or modify the teachings in the prior art *and* would have had a reasonable expectation of success in doing so.” *Regents of the Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018); *Intelligent Bio-Sys.*, 821 F.3d at 1367-68; *see also, e.g., NJOY, LLC v. JUUL Labs, Inc.*, IPR2024-00536, Paper 17 (P.T.A.B. Aug. 12, 2024) (denying institution where petitioner did not show a reasonable expectation of success in combining the asserted references); *Honeywell Int’l Inc. v. DSM IP Assets, B.V.*, IPR2024-00493, Paper 7 (P.T.A.B. Aug. 21, 2024) (same).

Beyond the reasons for discretionary denial (Sections V. and VI.), institution should be denied on the merits because the Petition fails to establish a reasonable likelihood of prevailing on any challenged claim, as explained below.

A. All Grounds fail to show any motivation to combine Khatibi with either Shinozaki or Kim with a reasonable expectation of success.

Under *KSR*, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (citation omitted). Moreover, Petitioner must demonstrate “that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *Intelligent Bio-Sys., Inc. v.*

Illumina Cambridge Ltd., 821 F.3d 1359, 1367–1368 (Fed. Cir. 2016) (citations omitted).

Petitioner does not provide a motivation to combine Khatibi with either primary reference or any explanation of a reasonable expectation of success.

Accordingly, Petitioner’s challenge must fail.

1. Petitioner does not provide any motivation to combine Khatibi with either Shinozaki (Ground 1) or Kim (Ground 2).

Petitioner fails to provide any rationale why a skilled artisan would have combined Khatibi with either primary reference (Shinozaki or Kim) to arrive at the specific claimed features of [1d], [1e], [6c], and [10b]. While Petitioner alleges “Reasons for combining Shinozaki with Toshio or Kim,” Pet., 11, and “Reasons for combining Kim and Griesi,” Pet., 58, it does not even provide any such allegations for Khatibi. Instead of providing any motivation to combine Khatibi with Shinozaki or Kim, Petitioner provides a section titled “Notes about Khatibi,” and merely posits that Khatibi is a “relevant disclosure” that “can relate to the CTE” of Shinozaki’s or Kim’s copper foils in their respective combinations. Pet., 13, 23, 61, 63 (citing, *e.g.*, EX1003, ¶47). But even if Khatibi is a “relevant disclosure,” that is not enough to show any motivation to combine Khatibi with Shinozaki or Kim, as recently confirmed by the Federal circuit in *Virtek Vision Int’l. ULC v. Assembly Guidance Systems Inc.*, 97 F.4th 882, 888 (Fed. Cir. 2024)

(“It does not suffice to simply be known. A reason for combining must exist.”).

Aside from the assertion that Khatibi is a relevant disclosure, Petitioner does not provide any “reason for combining” Khatibi with any reference.

Even if Khatibi’s disclosure *could* relate to the CTE of Shinozaki’s or Kim’s copper foils, Khatibi fails to disclose any CTE feature as claimed in [1d], [6c], and [10b]. And neither Shinozaki nor Kim suggest any reason to depart from their own formulations or copper foil treatments, let alone give any motivation to modify their respective material’s CTE or tensile strength characteristics or disclose how to measure such characteristics. Petitioner does not articulate any rationale why a skilled artisan would have been motivated to combine the teachings of the applied references in both of its Grounds.

Furthermore, Khatibi focuses solely on copper foil with relatively large grain size and emphasizes differences in CTE across different grain sizes. *See, e.g.*, EX1006, 1, 2 (showing grains “mostly comparable to or larger than the foil thickness,”), 4 (similar average grain size of 8 μ m for all thicknesses). In contrast, Kim (EX1012) is *silent* about its foil grain size, and Shinozaki’s grain sizes are all *below* 8 μ m for all thicknesses. *See, e.g.*, EX1004, Table 2; ¶8 (“grain size of not more than 5 μ m”). Petitioner or its expert does not explain why a POSA would have looked to Khatibi to modify Kim or Shinozaki, despite the differences in the grain sizes and their impact on CTE. EX1006, 1, 2, 4.

Moreover, Khatibi is about copper foils used for PCB applications and says nothing about secondary batteries. Petitioner fails to demonstrate why circuit/printed circuit board (IC/PCB) art (such as in Khatibi) would be relevant to secondary battery applications. Even if it had, that is not sufficient to establish that one of ordinary skill would have had reason to combine Khatibi's teachings with either Shinozaki or Kim, both of which are directed to the secondary batteries. *See Securus Techs., Inc. v. Global Tel*Link Corp.*, 701 F. App'x 971, 977 (Fed. Cir. 2017) ("a broad characterization of [prior art references] as both falling within the same alleged field . . . without more, is not enough for [Petitioner] to meet its burden of presenting a sufficient rationale to support an obviousness conclusion"). Mere compatibility of the references is likewise not sufficient. *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993 (Fed. Cir. 2017) (it is not enough to show that "a skilled artisan, once presented with the two references, would have understood that they could be combined.").

Petitioner's cursory approach here is akin to merely alleging that a combination of art would have been "intuitive," "common sense," or "obvious," without the requisite articulated rationale, which "is inadequate to support a finding that there would have been a motivation to combine." *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017). Indeed, the Petition's conclusory rationale "tracks the *ex post* reasoning *KSR* warned of and fails to identify any actual reason

why a skilled artisan would have combined the elements in the manner claimed.”

Id.; *KSR Int’l v. Teleflex Inc.*, 550 U.S. 398 (2007). Because Petitioner failed to present any credible arguments of motivation to combine, both of Petitioner’s Grounds must fail.

2. Petitioner does not provide any explanation why a skilled artisan would have had a reasonable expectation of success combining Khatibi with Shinozaki (Ground 1) or Kim (Ground 2).

Petitioner’s Grounds also fail because Petitioner does not show that a skilled artisan would have had a reasonable expectation of success combining Khatibi with Shinozaki or Kim. It is well-settled that it is Petitioner’s burden to demonstrate “that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, *and that the skilled artisan would have had a reasonable expectation of success* in doing so.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367-1368 (Fed. Cir. 2016) (citations omitted). Here, Petitioner does not address *any* expectation of success. Instead, as discussed above, Petitioner merely asserts that “Khatibi is a relevant disclosure that can relate to the CTE” of Shinozaki’s or Kim’s copper foils. Pet., 13, 15, 61, 63. Petitioner cannot satisfy its burden with this generic assertion, and this is another independent reason why both of Petitioner’s Grounds must fail.

B. The references and combinations do not disclose or suggest the claims' specific measurement conditions of the electrolytic copper foil's (1) coefficient of thermal expansion (CTE) or (2) tensile strength.

Petitioner applies three separate references (Khatibi for [1d] and Shinozaki/Kim for [1e]) for various features of [1d] and [1e], but none disclose or suggest the claimed features. Independent claim 1 requires:

[1d]	wherein: a coefficient of thermal expansion of the electrolytic copper foil, which is measured using a thermomechanical analyzer (TMA) while heating the electrolytic copper foil from 30° C. to 190° C. at a speed of 5° C./min, ranges from 16 to 22 $\mu\text{m}/(\text{m}\cdot^{\circ}\text{C.})$,
[1e]	a tensile strength of the electrolytic copper foil, which is measured after a heat treatment at a temperature of 190° C. for 1 hour, ranges from 21 to 36 kgf/mm ² ,

'689 patent, [1d] and [1e]. Independent claim elements [6c] and [10b] recite the same features. Petitioner relies on Khatibi (EX1006) in both Grounds for the coefficient of thermal expansion features in [1d], Pet., 15-18, 63-65, and on Shinozaki (EX1004) or Kim (EX1012) for the tensile strength features [1e], Pet., 18-19, 66. The same disclosures are applied to [6c] and [10b]. Pet., 50, 52, 73, 75. But none of Petitioner's references disclose the claimed features. And the cited portions of Dr. Randall's declaration mirror the Petition, providing no support for Petitioner's contentions.

1. CTE features - [1d], [6c], and [10b]

Claim limitations [1d], [6c], and [10b] all recite that CTE is measured (1)

using a thermomechanical analyzer (TMA), (2) while heating the electrolytic copper foil from 30°C to 190°C, at (3) a speed of 5°C/min. Petitioner does not contend that Shinozaki (Ground 1's primary reference) or Kim (Ground 2's primary reference) discloses a coefficient of thermal expansion (CTE) of their copper foil, let alone the specific features recited in [1d] (or [6c]/[10b]). Instead, Petitioner relies on Khatibi to fill this gap in both Grounds. Pet., 15-18, 63-65. But Khatibi does not disclose or suggest these elements. Khatibi discloses that its CTE was calculated using a "laser speckle based dilatometer" rather than a TMA as claimed. EX1006, 3. Further, Khatibi used "an equilibrium time of 10 min" with temperature stability achieved by a PID-controlled furnace, rather than while heating the electrolytic copper foil from 30°C to 190°C at a speed of 5°C/min as claimed. EX1006, 3. Khatibi's measurement conditions are thus completely different from those specified in [1d], [6c], and [10b].

Petitioner relies on Dr. Randall's unsupported, conclusory opinion that the claimed measurement conditions would "not significantly alter the results," Pet., 16-17 (citing EX1003, ¶¶56-59), and that "bulk copper" includes CTE of similar values. Pet., 16 (citing EX1003, ¶57). Dr. Randall goes as far to posit that the claimed range "should at least be considered representative of the CTE characteristics of electrolytic copper foil within this thickness and temperature range." Pet., 18 (citing EX1003, ¶60). But Dr. Randall provides no additional

support, and this portion of his declaration is a verbatim copy of the Petition.

Compare EX1003, ¶¶60, 180, *with* Pet., 18, 65. Dr. Randall provides *no explanation for these assumptions*—no description of background art, no examples, no studies, etc. Because Dr. Randall’s declaration “is conclusory and unsupported, adds little to the conclusory assertion for which it is offered to support, [it] is entitled to little weight.” *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 12 at 5 (P.T.A.B. Feb. 10, 2023) (Vidal, Dir.).

Moreover, Khatibi *itself* demonstrates Dr. Randall is wrong. Contrary to Dr. Randall’s assertion, Khatibi explains that CTE varies across temperature ranges and conditions. EX1006, 1. In particular, Khatibi explains that “*CTE...depend[s] on the foil type and may vary more critically for thin foils than for bulk material,*” EX1006, 2, and “[e]lastic and thermal parameters of copper foils are unique to the foil type and vary depending on the process parameters.” EX1006, 7. Accordingly, Khatibi directly undermines Dr. Randall’s assumption that the claimed measurement conditions would “not significantly alter the results.” Pet., 16-17 (citing EX1003, ¶¶56-59). It also demonstrates that Dr. Randall has no basis to shoehorn the CTE values Khatibi discloses for “bulk copper” (not thin foils) into the claimed CTE values for copper foils. Pet., 16 (citing EX1003, ¶57).

Further discrediting Petitioner’s arguments, another reference authored by Khatibi notes that values such as CTE “cannot be taken from bulk material.”

EX2018, 2. And the same reference indicates that “mechanical testing” of such parts is a “difficult task,” such that “conventional strain testing devices” are not used. EX2018, 2. In another study, Khatibi observed that the “deviation between bulk and foil material becomes especially pronounced with increasing temperatures,” EX2018, 10, and “the deviation is *especially pronounced for CTE*, and is attributable in part to the grain boundary contribution and a possible microcrack formation at voids due to thermal loading. This contribution increases with decreasing grain size.” EX2018, 10. These statements from another Khatibi reference further undercut Dr. Randall’s assumption that CTE for foils can be equated to CTE for bulk material. EX2018, 2.

Petitioner thus fails to demonstrate any of the combinations disclose the CTE features, including the specific measurement conditions, and fails to explain any sufficient reason why it would have been obvious for a POSA to measure a CTE in the recited conditions. Accordingly, both of Petitioner’s Grounds fail and the Board should deny institution.

2. Tensile strength features - [1e], [6c], and [10b]

Shinozaki (Ground 1’s primary reference) and Kim (Ground 2’s primary reference) each fail to specify the tensile strength measurement conditions or characteristics of [1e] (or [6c]/[10b]). Claim limitation [1e] (and [6c]/[10b]) specifies that a tensile strength of the ’689 patent’s claimed electrolytic copper foil

(1) ranges from 21 to 36 kgf/mm² and is measured (2) after a heat treatment at (3) a temperature of 190°C for (4) 1 hour. But again, Petitioner and Dr. Randall gloss over these specific elements and fail to explain how they are disclosed by Shinozaki or Kim.

Shinozaki describes that its foil has “a tensile strength of 300 N/mm² [30.6 kgf/mm²] or more at ordinary temperature. . . a tensile strength after an elapse of 15 hours at 150° C. of 250 N/mm² [25.5 kgf/mm²] or more.” Pet., 18 (citing EX1004, ¶50). Shinozaki also includes some ranges for an “untreated” copper foil. Pet., 18 (citing EX1004, Table 2). Shinozaki, however, does *not* disclose or suggest that the tensile strength value (1) ranges from 21 to 36 kgf/mm² *and is measured (2) after a heat treatment at (3) a temperature of 190°C for (4) 1 hour.*

Petitioner acknowledges that Shinozaki’s heating temperature differs from the claimed “heat treatment,” *see* Pet., 18-19, and tries to fill in the gaps with Dr. Randall’s testimony. *See, e.g.,* Pet., 18-19, 66. Dr. Randall opines: “[t]he claimed tensile strength ranging from 21 to 36 kgf/mm² indicates a broad range, and a heating temperature of 190° C for 1 hour would have had insignificant effect on changes on tensile strength;” “other prior art” show some tensile strength data for copper foils that fall within the range; and a “roughening treatment of the copper foil surface would likely have had insignificant effect on the mechanical properties (e.g., tensile strength of the copper foil), thus complying with the teachings of

Shinozaki.” EX1003, ¶¶61-62. This portion of Dr. Randall’s declaration is a near-verbatim copy of the Petition, and he provides no additional support for his conclusory opinions. *Compare* EX1003, ¶¶61-62 *with* Pet., 18-19. Because Dr. Randall’s declaration “is conclusory and unsupported, adds little to the conclusory assertion for which it is offered to support, [it] is entitled to little weight.” *See Xerox Corp.*, 5.

Worse yet, with respect to Kim, Petitioner does not even attempt to address Kim’s lack of disclosure regarding the conditions under which tensile strength is measured. Pet., 66. And while Kim describes that its copper foil “has a tensile strength of 30 to 40 kgf/mm²,” Pet., 66 (citing EX1012, ¶¶15, 29, Abstract, claim 3), that is not nearly enough to meet Petitioner’s burden to demonstrate obviousness of [1e] (or [6c]/10[b]). Kim does not disclose that the tensile strength measurement is made after a heat treatment at a temperature of 190°C for 1 hour, as required by the claims. Petitioner again attempts to fill these gaps with Dr. Randall’s testimony, but he again provides no support for his conclusory opinions. *Compare* Pet., 66 *with* EX1003, ¶¶179-180.

Accordingly, Shinozaki’s and Kim’s measurement conditions are different from those specified in [1e], [6c], and [10b].

Moreover, Petitioner’s own cited art discredits its arguments. For example, Khatibi describes that “[i]t is established that experimental determination of these

parameters is of high significance in design and reliability” and that “[e]lastic and thermal parameters of copper foils are unique to the foil type and vary depending on the process parameters.” EX1006, 1, 7. Khatibi further cautions that in some cases “instability of the microstructure[] results in an remarkable increase of CTE values above 150°C.” EX1006, 6. After reading Khatibi, a POSA would have understood that specific experimental determination of Shinozaki’s, Kim’s, and the other references’ elastic and thermal parameters is required—Petitioner ignores this, along with the fact that Khatibi also does not disclose the measurement conditions specified in [1e], [6c], and [10b]. Khatibi’s teaching that elastic and thermal parameters of copper foils are *unique* to the foil type *and vary dependent on the process parameters* would have indicated to a POSA that Petitioner’s assumptions about the interchangeability of the art’s respective disclosures are not supported.

In sum, Petitioner’s analysis of the tensile strength features is flawed at every turn. Petitioner fails to demonstrate the *any* of the combinations disclose the tensile strength features, including the specific measurement conditions. Petitioner fails to explain any sufficient reason why it would have been obvious for a POSA to apply tensile strength features from one reference to another. Petitioner ignores that its own art undermines their conclusory allegations. And Petitioner’s declarant merely provides opinions that are copy-and-pasted from the Petition, without

additional analysis or explanation.

* * *

For at least these reasons, Petitioner fails to demonstrate any of the combinations disclose the CTE features or tensile strength features of [1d], [1e], [6c], and [10b]. Accordingly, both of Petitioner’s Grounds fail and the Board should deny institution.

C. The claims require *both* 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,” but Petitioner provides only a conclusory rationale to apply a protective layer on both surfaces.

Elements [1b] and [1c] (and [6c]/[10d]) require 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.” Although Petitioner appears to acknowledge that none of the references discloses both of these limitations and relies on obviousness theories, Petitioner fails to explain why meeting both of these limitations would have been obvious.

Petitioner collapses limitations [1b] and [1c] together in Ground 1 and alleges that the secondary reference “Toshio or Kim *renders obvious* [1b]-[1c].” Pet., 14-15. Petitioner relies on Toshio’s disclosure that a protective layer is applied to “achieve rust prevention between the copper foil surface of the current collector and the active material for electrodes of secondary batteries.” Pet., 14-15. But Toshio only describes a rust-prevention feature on a roughened surface. Pet.,

15 (citing EX1014, claim 6, claim 9, claim 10, ¶¶31, 74, 92, 93; *see also* ¶13). Dr. Randall similarly states that there should be “rust prevention between the copper foil surface of the current collector and the active material,” but then makes an unsupported leap without explanation that there should be rust prevention on both sides of Shinozaki’s foil. EX1003, ¶54.

Further, neither Petitioner nor Dr. Randall articulates any motivation to combine Toshio with Shinozaki, or any persuasive reason to include Toshio’s rust prevention on both sides of Shinozaki’s copper foil. Pet., 14-15; EX1003, ¶54. Similarly lacking is any explanation of expectation of success in modifying Shinozaki or combining Shinozaki with Toshio in this way. Pet., 14-15; EX1003, ¶54.

Petitioner’s reliance on Kim fares no better. Petitioner alleges that “[a]lternatively/additionally,” Kim “describes use of a protective layer over copper foil surface at least for purposes of preventing corrosion.” Pet., 15. Kim’s disclosure does *not* support that it would have been obvious to coat both surfaces of its foil. Rather, all of Kim’s disclosures regarding corrosion-protection that Petitioner cites focus on a *singular surface or layer*. Pet., 15 (citing EX1012, ¶7 (discussing how Kim’s foil is coated with “a protective layer”), 24 (“*the* surface of the copper foil is chromated to prevent corrosion”), 25 (“*the* surface of the copper foil is finally chromated”), 28 (foil “is surface chromated”)); EX1003, ¶55.

Petitioner then cursorily concludes that it “would have been obvious for a POSITA to apply the protective layer to both surfaces of the copper foil to achieve the same anti-corrosion effect on both surfaces of the copper foil.” Pet., 15. This, too, is an unsupported assertion and should be rejected. And as with Toshio, there is no articulated motivation to combine Kim with Shinozaki or modify Shinozaki with Kim, nor any persuasive reason to include Kim’s corrosion prevention on both sides of Shinozaki’s copper foil. Pet., 14-15; EX1003, ¶54. Similarly lacking is any explanation of expectation of success in modifying Shinozaki or combining Shinozaki with Kim in this way.

Ground 2, which applies Kim as the primary reference, points to the same portions of Kim as Ground 1 for alleged support and is deficient for the same reasons. Pet., 62-63. Again, there is no articulated motivation to modify Kim, and no persuasive reason to include Kim’s corrosion prevention on both sides of its foil. Pet., 62-63; EX1003, ¶173. Similarly lacking is any explanation of expectation of success in modifying Kim in this way. Pet., 62-63; EX1003, ¶173.

Accordingly, not only does Petitioner fail to provide adequate motivation to modify Shinozaki or Kim to arrive at [1b] and [1c] as claimed, but the art itself does not support the premise for which Petitioner relies on it. Therefore, both of Petitioner’s Grounds fail and the Board should deny institution.

D. The references and combinations do not disclose or suggest the peak count (Pc) limitation of [1g], [6c], or [10b] at all, even for one side of a copper foil.

Petitioner fails to demonstrate how any art discloses or renders obvious the Pc limitations of [1g] (and [6c]/[10b]). The references do not disclose measuring a Pc using the limitation's conditions, and Petitioner's argument that one could determine a Pc based on other roughness parameters lacks merit.

1. None of Petitioner's art disclose determining a Pc in the manner required.

The Petition begins with the premise that Pc (peak count) is a well-recognized measurement parameter that reflects the number of peak counts or effective peaks based on “(i) an ‘upper criteria line’ and (ii) a ‘lower criteria line’ per (iii) ‘unit sampling length’.” Pet., 20-22. But regardless of whether Pc is a recognized *measurement*, Petitioner *ignores* the requirements that the measurement includes (1) an upper criteria line, (2) a lower criteria line, and (3) any unit sampling length. *See* Section III. The Pc limitations require a specific upper criteria line (i.e., 0.5 μm), specific lower criteria line (i.e., -0.5 μm), and specific sampling length (i.e., 4mm), as explained by the '689 patent. None of Petitioner's art addresses any of these features.

Petitioner relies on Yacovone (EX1025)—a reference that says nothing about a copper foil or secondary batteries—to suggest that Pc was a well-recognized measurement. Pet., 23. But Yacovone does not provide any teaching or

suggestion that one should use criteria lines of +/- 0.5 μm and unit sampling length of 4 mm, as claimed. To the contrary, Yacovone discloses using a *different* sampling length (i.e., 2.5 mm) and highlights the need to know the criteria lines for the determination of R_{pc}. EX1025, ¶50 (“The peak count is dependent on the profile type, and an upper and lower boundary (C1 and C2).”). Additionally, Yacovone confirms that, as the Applicant successfully argued during prosecution of the ’689 patent, P_c cannot be ascertained from R_z because the two are different parameters. EX1025, ¶50 (“R_z values alone do not characterize the complete profile of the surface.”).

Petitioner’s reliance on the MarSurf M300 manual (EX1020) is likewise misplaced. Pet., 23. Like Yacovone, the MarSurf M300 manual discloses that the values for the “intersection lines” *must be set*:

Setting the intersection lines for peak count

To calculate the peak count RP_c , an upper intersection line C1 (35) and a lower intersection line C2 (37) are placed into the roughness profile. Both intersection lines are parallel to the diagram mean line (36).

The distance (in μm or μin) from the intersection lines to the diagram mean line can be set to symmetrical or asymmetrical values.¹⁶

To set a symmetrical distance from the intersection lines C1 and C2 to the diagram mean line:

1. Set the upper intersection line C1.
The value for the lower intersection line C2 is automatically set to -C1.

To set an asymmetrical distance from intersection lines C1 and C2 to the diagram mean line:

1. First set the value for C1. The value for the lower intersection line C2 is automatically set to -C1.
2. Then select the "C2" button by pressing the key and set the desired distance C2 for the lower intersection line.
If the value is negative, the intersection line lies below the diagram mean line.



Each time the value for C1 is changed, C2 is reset to -C1. If $C2 \neq -C1$ is required, C2 must then be reset.

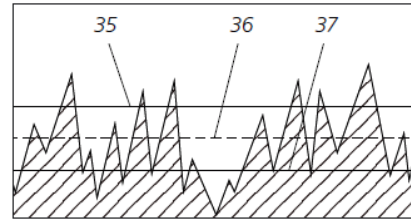


Fig. 7
Intersection lines for peak count

35 Upper intersection line C1
36 Diagram mean line
37 Lower intersection line C2

EX1020, 11.

The manual also states that determining peak count requires peaks exceeding the *set* upper criteria line that then fall short of the *set* lower criteria line:

RP_c	Peak count RP_c (dependent on intersection lines C1 and C2): Number of profile elements (see RS_m) per cm (or per inch) which first exceed the set upper intersection line C1 and then fall short of the lower C2.	EN 10049: 2005 ASME B46.1-2002 E DIN EN ISO 4287/A1: 2007-07 (D)
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EX1020, 41. Conspicuously absent from the manual is *any* relationship between Pc and any other parameter. The manual references RSm relating to “profile elements,” (shown above as a peak/valley pair without regard to any criteria lines). But Pc requires counting only peaks that exceed the *set* upper criteria line and then fall short of the *set* lower criteria line. EX1020, 11, 41.

Nor does the ASME standard (EX1021, 21) disclose the claimed criteria lines or unit sampling length. Pet., 22. The ASME standard discloses that peak count (referred to as “peak density” or “Pc” in the ASME standard) is dependent on the consecutive crossing of the lower and upper boundary lines but leaves the values of the boundary lines at a user’s discretion. EX1021, 21 (“The boundary lines ... are set by a designer or an instrument operator for each application.”). Further, the ASME standard differentiates peak *count* from peak *spacing*, undermining Petitioner’s attempt to determine one from the other. EX1021, 22. Figures 1-13 and 1-14, shown below, illustrate that while RSm does not depend on *any boundary lines*, peak count requires a “peak count level” having both an upper and lower boundary line:

Fig. 1-13 The Mean Spacing of Profile Irregularities, RS_m

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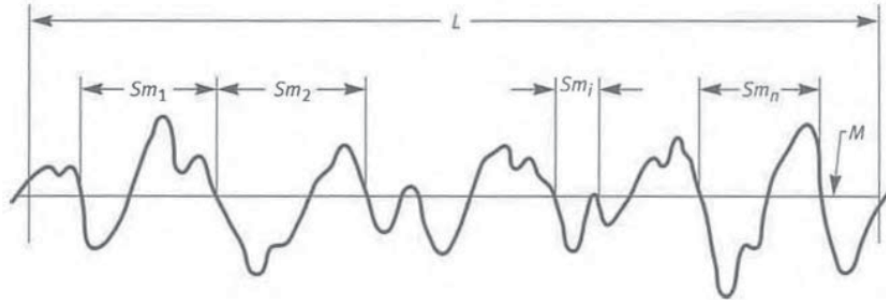
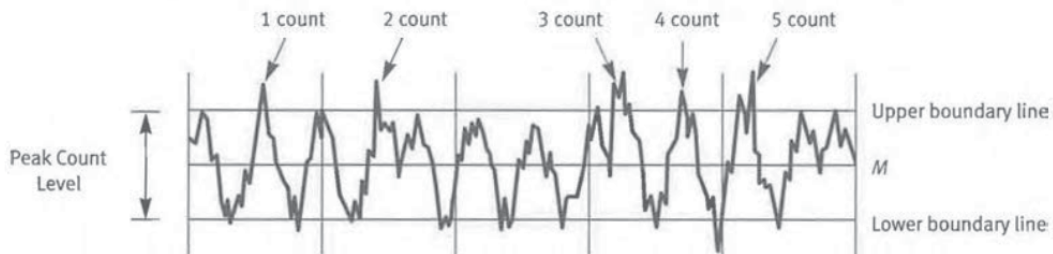
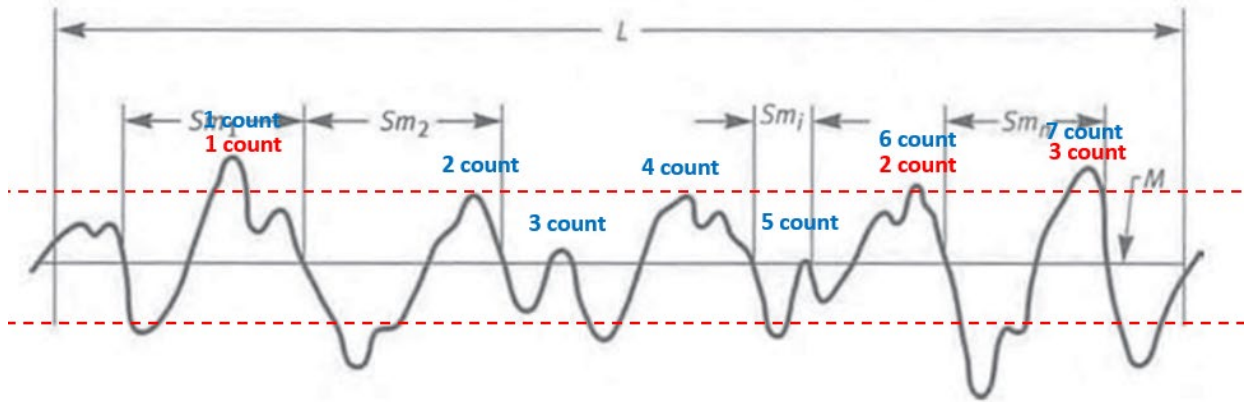


Fig. 1-14 The Peak Count Level, Used for Calculating Peak Density



EX1021, FIGs. 1-13 and 1-14.

These figures do not specify (1) a unit sampling length of 4 mm; (2) upper criteria line of 0.5 μm ; (3) lower criteria line of 0.5 μm ; or (4) even how the surface profile is obtained—all features specifically required by [1g] (and [6c]/[10b]). An annotated version of EX1021's FIG. 1-13 below illustrates the significance of criteria lines in a Pc measurement:



EX1021, FIG. 1-13 (annotated).

The dashed red lines show exemplary criteria lines, with corresponding peak counts shown along the profile. The peak count would be seven if measured without the criteria lines (annotated in blue) and three if measured with the criteria lines (annotated in red). And depending on where the criteria lines are, one would measure a peak count that falls in between this range. Thus, Petitioner cannot show that, unless a reference specifies the height of the criteria lines used for measuring Pc, a Pc value that appears in a reference meets the claimed Pc range.

Finally, Petitioner's reliance on the DIN EN 10049 2014 Standard (EX1036) fails for the same reason: this standard explains that there must be a defined upper and lower "section line" for consecutive intersections, calculated over a specified evaluation length. EX1036, 14 (showing a figure similar to EX1021, FIG. 1-14 and the '689 patent's FIG. 2).

The Petition concludes that "Pc or Rpc, as claimed in the '689 Patent" is a well-recognized measurement parameter. Pet., 23. Whether or not Pc is generally

known, all of Petitioner's references recognize there must be a specified upper criteria line, lower criteria line, and sampling length. None of these are disclosed by Petitioner's applied references. And Petitioner does not even attempt to explain why a POSA would have used the values required (+/- 0.5 μm criteria lines and sampling length of 4 mm) in view of the references it relies on.

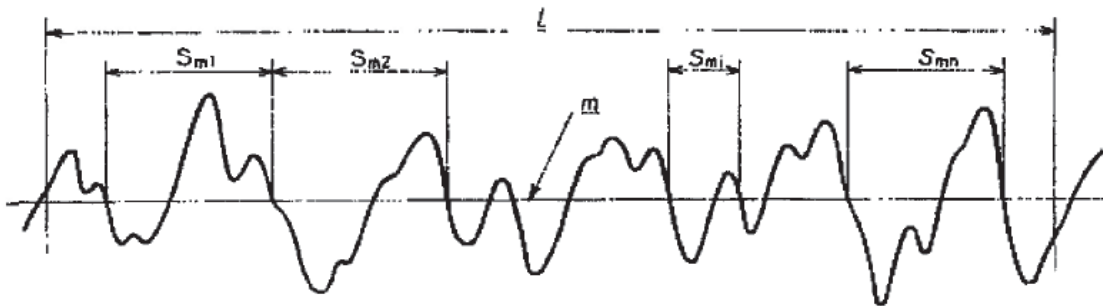
2. Pc cannot be obtained from other surface roughness parameters such as Rsm/Sm, Ra, or Rz/Rzjis.

Contrary to Petitioner's claim, Pet., 24, *Pc cannot* be obtained from other surface roughness parameters such as Rsm or Sm. Rsm and Sm relate to distance between peaks and do not take into account any criteria-line crossing determinations. In contrast, *Pc requires* (1) an upper criteria line to be specified, (2) a lower criteria line to be specified, so that (3) only peaks that consecutively cross these lines are counted along (4) a specified sampling length. Rsm and Sm do *not*. See, e.g., EX1025, ¶¶50-52; EX1020, 11, 40; EX1021, 21-22, FIGs. 1-13 and 1-14; EX1036, 14. Petitioner cites the DIN EN ISO 4287 standard (EX1019) for the proposition that $Pc = L / Rsm$. Pet., 24. But the DIN EN ISO 4287 standard is plain that the peak count calculation *requires* height discrimination, EX1019, 12, defined as "minimum height...of profile peaks and profile valleys of the assessed profile which should be taken into account." EX1019, 12. The DIN standard thus does not support Petitioner's assertion that *Pc* and Rsm are in a simple inverse relationship. Further, Exhibit 1019 discloses that the "default height

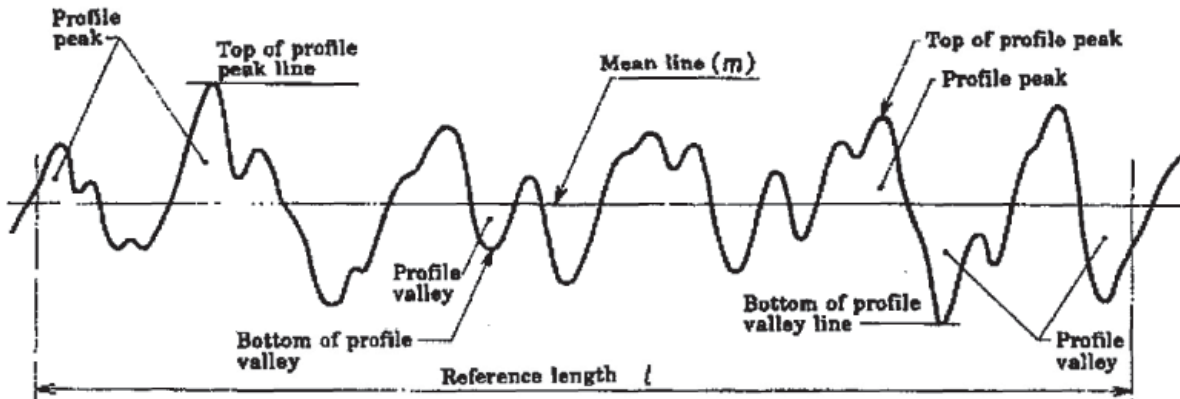
discrimination” shall be 10% of R_z , EX1019, 17, 18, and that the preferred (and only) reference length is 10 mm, EX1019, 18, both of which are *different* from the required conditions for the criteria lines and sampling length (i.e., $\pm 0.5 \mu\text{m}$ and 4 mm, respectively).

Petitioner also cites JIS B 0601. Pet., 25; EX1017. But that standard also shows that R_{sm}/S_m , *see, e.g.*, EX1017, FIG. 5, does *not* require criteria-line crossing discrimination. This is evident from Exhibit 1017’s S_m -related figures, which show no criteria line at all:

Fig. 5. Determination of S_m



EX1017, FIG. 5.



EX1017, FIG. 1(b).

See also EX1018, 7 (defining profile peak and profile valley as connecting two adjacent points of the intersection of the profile with the X-axis); EX1018, 14 (explaining RSm and requiring height discrimination and spacing discrimination, provided in percentages of maximum height and percentage of the reference length); EX1023, 9 (noting that RSm “is used to evaluate the horizontal size of parallel grooves and grains instead of the height parameters.”).

Nor do the other roughness parameters relied on by Petitioner, namely Ra and Rz, support Petitioner’s attempt to derive Pc from Rsm. Ra measures *absolute deviation* from the mean height and treats peaks and valleys equivalently—it cannot be used to derive Pc. Similarly, because Rz represents the average magnitude of the five highest peaks and valleys, Rz provides no information about the number of peaks that cross certain threshold values within a sampling length. Indeed, these are precisely the roughness measurements that were successfully distinguished during prosecution. *See* EX1002, 29-34 (distinguishing an applied references Rz/Rzjis measurements from the claimed Pc).

A simple, intuitive figure illustrates Petitioner’s illogical assumptions. Two exemplary surfaces shown below⁵ with specified unit-less peak heights (2, 4, 6, or

⁵ For purposes of illustration, the figures show only the peaks and not the valleys.

8 as marked in the figure) have the *same* sample length, *same* Ra, *same* Rz, and *same* Rsm/Sm. Yet, depending on where the criteria line is set, the two samples would have *different* Pc/Rpc values along the length shown:

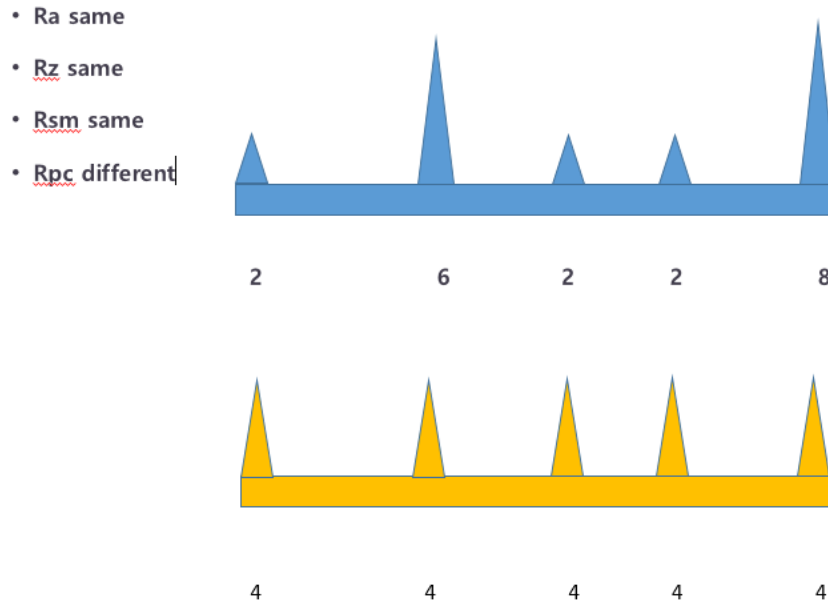


FIG. A.

In sum, Petitioner's attempt to derive a Pc value via different roughness parameters such as Rsm strains credulity. This bleeds into Petitioner's failure, discussed above, to demonstrate a sufficient motivation to modify and combine the references and establish a reasonable expectation of successfully arriving at the claimed electrolytic copper foil for a secondary battery.

a. Petitioner's "first approach" suffers fatal flaws.

In attempting to arrive at the claimed Pc range, Petitioner (1) makes unreasonable assumptions about Shinozaki's example data, (2) applies a

convoluted Gaussian analysis that is unsupported by any reference, and (3) stretches its “recognized result-effective variable” rationale beyond reason.

Shinozaki—like the other references—does *not* disclose any Pc values. Petitioner’s attempt to re-write Shinozaki’s disclosures should be rejected.

Acknowledging that Shinozaki’s data it relies upon “do not specify upper and lower criteria lines,” Pet., 15, Petitioner and Dr. Randall propose *adjusting the measurement conditions to manipulate the Pc*. Specifically, Dr. Randall opines that “by controlling *R_{pc}* based on its peak height threshold (which can be similar to a height-related parameter, such as Ra), a POSITA can obtain certain surface profile characteristics, such as consistency or distribution of peaks that meet the threshold height.” EX1003, ¶18. But what Dr. Randall suggests is that a skilled artisan would *control* the peak height threshold to control Pc, rather than *measure* or *evaluate* Pc based on a specified peak height threshold. EX1003, ¶18. This is backwards—a POSA would control surface characteristics or functional properties of a material (e.g., through manufacturing processes) and *then* measure the Pc using agreed-upon criteria lines and sampling length to provide a quantified number of effective peaks to characterize the material. To change upper/lower criteria lines or sampling length, as Petitioner proposes, results in an apples-to-oranges comparison that cannot be reconciled with the claims.

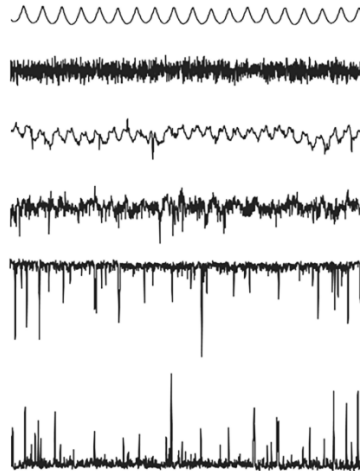
The Petition first relies on Dr. Randall's unsupported assertion that one of Shinozaki's example Ra values, namely $0.46\text{ }\mu\text{m}$ (mean absolute deviation of the surface profile from the central mean line, Pet., n.4) can be used "as proxy for the upper and lower criteria lines of $\pm 0.5\text{ }\mu\text{m}$." Pet., 27, citing EX1003, ¶83. But the Petition provides no reason this value could be used as a proxy for the claimed features. Dr. Randall's assertion is merely a cherry-picked value that happens to be near, but not even the same as, the Pc limitation's requirement of upper and lower criteria lines (for both sides of the foil) of $\pm 0.5\text{ }\mu\text{m}$. Shinozaki does *not* describe *any* criteria lines, nor does it disclose that its Ra value could or would be a proxy for *any other surface characteristic*. See, e.g., EX1004, Table 3.

Petitioner then makes another unsupported assumption that a skilled artisan "would have known to estimate that approximately half of the peaks and valleys in Shinozaki's example will rise above and fall below the Ra or upper/lower criteria lines of $\pm 0.5\text{ }\mu\text{m}$." Pet., 28, EX1003, ¶42. But Ra—as the Petition acknowledges—does not describe any distribution of peaks; rather, it just represents the average roughness, "calculated as the mean deviation of the surface profile from the central mean line over a specified sampling length." Pet., n.4. Simply put, an Ra value by definition cannot provide any information about the number of peaks, location of peaks along a surface, or any single peak's height relative to a criteria line. Shinozaki does not suggest otherwise. Indeed, Shinozaki

does not disclose any criteria lines or peak counts, much less support the inference that Ra can be used to determine Pc.

As discussed above, *see* Section VII.D.1, with respect to Petitioner's background references, Ra measures *absolute deviation* from the mean height, and it treats peaks and valleys equivalently.⁶ So there is no support for Petitioner's assertion that half of Shinozaki's peaks will be above or below the mean line. Pet., 28; *see also* Pet., 31 (similar misstatements related to Rz as an average measurement). Ra *cannot* distinguish the location of surface features across a profile. Indeed, a surface with randomly scattered peaks along a profile can have the *same* Ra as a surface with those same peaks clustered at one end of the profile. As an example, each of the six very different surfaces shown below all have similar Ra values—Ra does not give any information about peak count:

⁶ Because Rz represents the sum of the absolute values of the five highest peaks and the absolute values of the five lowest valleys, divided by 5, Rz similarly cannot be used to derive Rpc.



EX2017, 7.

Similarly, as also discussed above for Petitioner's background references, Pc *requires set* upper and lower criteria lines for one to determine qualifying peaks, but Rsm/Sm does not. *See, e.g.*, EX1025, ¶¶50-52; EX1020, 11, 40; EX1021, 21-22, FIGs. 1-13 and 1-14; EX1036, 14. The Petition states that Sm is the mean value of the profile element widths within a sampling length, but also that SM does not specify any criteria line qualification for profile elements. Pet., 25-26. So, without any indication from a reference such as Shinozaki that its Rsm/Sm values discriminate based on the same set upper and lower criteria lines and count peaks in the same way, they simply cannot be used to calculate Pc.

Indeed, the Petition implicitly acknowledges this. It states that Dr. Randall (even after his aforementioned convoluted math and assumptions) also assumes that there may not always be peaks and valleys which consecutively exceed his contrived criteria, so "the actual R_{pc} [sic] is likely to be slightly less than, if not

equal to, the Rpc estimate [sic]” that he himself created for Shinozaki’s Working Example 6. Pet., 29 (citing EX1003, ¶85). But neither the Petition nor Dr. Randall explains how a skilled artisan would be able to estimate—based on Shinozaki’s material—how many peaks and valleys are *not* consecutively exceeding his own criteria, since there is no actual profile information contained in Shinozaki. As a result, there is no way to evaluate—even under Dr. Randall’s first approach—to what extent he believes the actual peak count would be less than his estimate.

Accordingly, Shinozaki does not disclose or render obvious the Pc features as required by the claim limitations of [1g] (and [6c]/[10b]) under Petitioner’s first approach.

b. Petitioner’s “second approach” also suffers fatal flaws.

Petitioner calls Dr. Randall’s second approach a “more mathematically rigorous approach.” Pet., 17. In actuality, it relies on fabricated data and unsupported assumptions. Dr. Randall requires Shinozaki’s data to be entirely “re-developed,” (Dr. Randall’s words) and forced into a Gaussian distribution. Pet., 29; *see* EX1003, ¶¶86-98. Dr. Randall then layers on multiple unreasonable assumptions under the guise of “mathematical[] rigor[].” Dr. Randall’s convoluted analysis merely underscores the baselessness of Petitioner’s obviousness analysis. *See* EX1003, ¶¶86-98.

As an initial matter, Petitioner points to Bhushan (EX1024) to support Dr.

Randall's Gaussian "re-development" of Shinozaki's data. Pet., 29. But Petitioner and Dr. Randall ignore Bhushan's guidance that in order to make use of a Gaussian model and assumption, a "goodness of fit" test should be applied. As Bhushan explains:

The most practical method for the goodness of the fit between the given distribution and the Gaussian distribution is to use the Kolmogorov-Smirnov test....[A] calculation is made to determine if the distribution is indeed Gaussian....The chi-square test (Siegel, 1956) can also be used to determine how well the given distribution matches a Gaussian distribution.

EX1024, 10. Neither Petitioner nor Dr. Randall attempt to explain how to confirm that Shinozaki, or any other reference for that matter, would actually be Gaussian. A "goodness of fit" test is of no use, since it is Dr. Randall's manufactured data, not Shinozaki's actual data, which he forces into a Gaussian distribution. Petitioner also ignores Bhushan's comments related to other roughness parameters or profile types. For example, Bhushan notes that "a profile with a very narrow spectrum has no peaks below a mean line, whereas a white noise profile with infinite spectral width has half of its peaks below this line." EX1024, 26 (further demonstrating the unreasonableness of Petitioner's first approach, since peak *spectrum* would affect peak *count*).

Worse yet, the Petition goes on to re-write Shinozaki's data, randomly

multiply Shinozaki's Ra values by 2 to guess at an average peak-to-valley height of the surface profile, and then shoehorn this re-written data into a Gaussian distribution. *See* Pet., 30-34. Even in this second approach Petitioner admits that it “derive[s] [Pc] from Sm without considering the upper/lower criteria lines.” Pet., 31-32. Nothing about this convoluted approach makes sense, or would have been obvious.

c. Pc is not a recognized result-effective variable.

Further to the two flawed approaches discussed above, Petitioner attempts a catch-all approach. Petitioner baldly asserts that Pc is a recognized result-effective variable, and so it would have been obvious to optimize the applied art to satisfy the claimed ranges. Pet., 35. But it is the '689 patent *alone* that describe the effect of Pc, discovered by the '689 patent's inventors—not any of the Petitioner's art.

Even assuming that there was motivation to optimize the applied art, Petitioner's obviousness analysis fails because the claimed variable (here, Pc as required in [1g] (and [6c]/[10b]) and described the '689 patent's specification) was *not recognized* in the prior art as a result-effective variable. *E.I. Dupont de Nemours & Company v. Synvina C.V.*, 904 F.3d 996, 1008 (Fed. Cir. 2018). In *E.I. Dupont*, the Federal Circuit explained that:

[A] person of ordinary skill would not always be motivated to optimize a parameter “if there is no evidence in the record that the prior art recognized that [that] particular parameter affected the

result.” *Antonie*, 559 F.2d at 620.) For example, in *Antonie* the claimed device was characterized by a certain ratio, and the prior art did not disclose that ratio and was silent regarding one of the variables in the ratio. *Id.* at 619. Our predecessor court thus reversed the Board’s conclusion of obviousness. *Id.* at 620.

This is directly on point here, where *none* of Petitioner’s art supports that Pc—described and required by the ’689 patent’s claims—was a recognized result-effective variable.

i. Petitioner’s art does not recognize Pc as result-effective.

Petitioner cites Shinozaki’s disclosure that one could control Ra and Rz to achieve certain purported advantages such as increasing anchoring or avoiding voids. Pet., 35; EX1004, ¶¶73-74. But as discussed above, Shinozaki does *not* disclose Pc, and neither Ra nor Rz provide a skilled artisan with information related to a surface’s Pc, let alone measured in the way required by the ’689 patent’s claims’ limitations. *See* Section IV. That Shinozaki allegedly discloses Ra and Rz as relevant parameters for controlling for a material’s surface does not mean that Shinozaki discloses that Pc is a result-effective variable. *See* Pet., 35, 37, 39.

Petitioner also references Gadelmawla as allegedly supporting its result-effective argument. Pet., 39-40 (citing EX1016). But Gadelmawla distinguishes between *height* parameters like Ra, Rz, *see* EX1016, 1-3, and *spacing* parameters

like peak count, EX1016, 7-8. *See also* EX1016, 4-6 (demonstrating that Gaussian distribution of peaks is not a reliable assumption due to skewness/kurtosis).

Gadelmawla does emphasize that in pressing sheet steel or producing brake drums, controlling certain spacing parameters may be desirable. EX1016, 7-8. But Gadelmawla gives no particular guidance to a skilled artisan. *See E.I. Dupont* at 1008. For example, although Gadelmawla generally states that “controlling the spacing parameters [makes it] possible to obtain better bounding of finishes, more uniform finish of plating and painting,” such a statement does not support the proposition that Pc is a result-effective variable. EX1016, 7.

Petitioner misrepresents Gadelmawla by changing “bounding” in the text to “bonding,” Pet., 35, presumably attempting to draw a parallel to the ’689 patent’s adhesion benefits. While Gadelmawla states that in some instances, controlling spacing parameters may obtain *better bounding* (e.g., better marking or forming of the limits) *of finishes* resulting in *more uniform finish of plating and painting*, EX1016, 7, Gadelmawla does not include any statement associating spacing parameters and adhesion. Further, under Dr. Randall’s own words, Gadelmawla is about “frictional contact or mechanical grip” such as in brake drums and has nothing to do with a current collector and active material of secondary batteries. Pet., 35-36 (citing EX1003, ¶104). While Gadelmawla acknowledges that the “importance of the peak count parameter appears in some manufacturing processes

such as forming, painting, or coating surfaces,” Gadelmawla does not provide any detail *at all* about how the parameter may influence these manufacturing processes or products produced by such processes. EX1016, 7. And—just like Petitioner’s other references—Gadelmawla still recognizes the distinction between peak count and Sm. EX1016, 7-8.

Finally, as with Petitioner’s first and second approaches, *see* Sections VII.D.2.a-VII.D.2.b, Petitioner acknowledges Pc is categorized as a spacing parameter. Pet., 36. But in the same breath, Petitioner advances an illogical premise. Petitioner alleges that because Pc uses upper/lower criteria lines, Pc determination “establishes a correlation with height (e.g., amplitude) parameters” like Ra, even though there is no connection to a sample length or criteria lines of Pc, as required by the claims’ limitations. Pet., 36. Petitioner continues:

Therefore, if Pc’s upper/lower criteria lines are set to values such as $\pm 0.5 \mu\text{m}$ that are similar to average height Ra value(s) taught in Shinozaki (e.g., Ra of 0.25-0.7 μm), then Pc becomes correlated with Ra, as they both express height characteristics.

Pet., 24; *see also* EX1003, ¶64 (“In other words, Ra and Pc are correlated in certain scenarios.”). But these are unreasonable premises. As explained above, there is no relation between Ra and any criteria lines as required by Pc, and these premises are not supported by *any* of Petitioner’s references.

ii. Petitioner admits that it is artificially controlling Pc rather than measuring Pc as specified by the claims.

Petitioner admits, *see* Pet., 36, 38, 40, that it is artificially “*controlling Pc*” “based on its height characteristics (e.g., upper/lower criteria lines),” or Ra. Pet., 36. This underscores Petitioner’s hindsight analysis of the ’689 patent’s critical, specific Pc ranges. Petitioner asserts that its approach “target[s] and obtain[s] certain surface profile characteristics.” Pet., 36-37.

But changing a measurement’s upper/lower criteria lines does nothing to change surface profile characteristics, only its expressed measurements. A simple example illustrates the unreasonableness of Petitioner’s assumption. Assume a customer orders a product with a specified Pc and specifies the upper and lower criteria lines and sample/evaluation length to be used in the measurement of Pc. Petitioner’s rationale would allow a manufacturer to pick and choose its *own, independent*, criteria line to meet the customer’s Pc requirements. Only the ’689 patent—not Petitioner’s art or declarant—explains the criticality of the specifically measured (and claimed) Pc ranges the inventors discovered:

When the peak count (Pc), is less than 3, an active specific surface area of the electrolytic copper foil 110 which may come in contact with the negative electrode active material is too small to ensure sufficient adhesion...

On the other hand, when, the peak count (Pc) is more than 92 or the surface roughness (Rz) is more than 3.5 μm , coating uniformity of the negative electrode active material is lowered due to too many surface irregularities, and thus the adhesion between the electrolytic copper foil 110 and the active material layers 120a and 120b is significantly lowered.

'689 patent, 7:65-8:10. Artificially controlling Pc, as Petitioner suggests, rather than actually measuring Pc as specified by the '689 patent, is an act of impermissible hindsight. It ignores the claim limitations' requirements and any reasonable reading of Petitioner's art.

iii. Petitioner's background art and Griesi (Ground 2) does not cure the defects the asserted Grounds.

None of Petitioner's background art cures the deficiencies in Petitioner's Pc arguments. In Ground 2, Petitioner also relies on Griesi's (EX1015) Rz—again, just like Shinozaki's Rz features. Pet., 57-58. Because Rz represents the average magnitude of the five highest peaks and valleys, Rz provides no information about the number of peaks that cross certain threshold values within a sampling length. Griesi, at best, has a passing reference to "RPc," with no discussion at all of what that is, measured on just one side of its foil. *See, e.g.*, EX1015, 28-29, 54). Moreover, Griesi describes *differences in roughness* of the sides of copper foil (contrary to [1g]'s requirement). *See* EX1015, 29, 38.

Petitioner further points to a single figure in Griesi showing a “receipt” from a perthometer. Although the receipt includes an “RPc” value, Griesi provides no context or discussion as to what the “RPc” value represents or how it is measured. Indeed, Griesi states that the perthometer “does not record discrete data points” and discloses no data points underlying the single receipt. So it is impossible to ascertain what Griesi’s “RPc” represents and how it is measured. Tellingly, Petitioner cannot even assert that Griesi’s “RPc” was measured with a sample length of 4 mm and criteria lines of $\pm 0.5 \mu\text{m}$ as the ’689 patent claim limitations’ require.

Ground 2 follows the same formula as Ground 1, Pet., 57-61, pointing to Petitioner’s same, faulty assumptions—and thus Ground 2 similarly fails. *See* Section VII.D.1-VII.D.2.

Petitioner asserts that Fabian (EX1005), shows Pc values are useful for enhancing uniformity or void reduction of a copper foil surface. Pet., 37. But Fabian does not support Petitioner’s assertion. Rather, just like Petitioner’s other references, Fabian expressly states that a “surface profile can have the same surface roughness with a different number of PPC [(peaks-per-centimeter), similar to peak count].” EX1005, 7-8. And Petitioner acknowledges that Fabian does not provide the criteria lines for its PPC measurements (buried in footnote 9) *and* assumes that Fabian’s PPC measurement can be translated to the claimed 4 mm

unit sampling length (buried in footnotes 10 and 11). Petitioner’s statement of a generic desire to “enhance uniformity or void reduction of copper foil surface,” Pet., 42, is merely a bald assertion about what could have been achieved at the time of the invention.

Petitioner also contends that “[a]dditionally” Fabian’s PPC values could be used to form a current collector for secondary batteries, and that Fabian supports that the Pc range in the ’689 patent’s claims was known to be effective for surface adhesion characteristics. Pet., 43-44. Not so. As a threshold matter, Fabian fails to support Petitioner’s contention that PCB and microelectronics electrodeposited copper foils are compatible with use in secondary batteries. Pet., 43. Fabian is *solely* related to PCB and IC, and Fabian does not even describe PPC’s effect on *those applications*. See generally EX1005; see also EX1011 (passing reference to battery applications tied only to Rz and Rmax, not Pc); EX1007, ¶107 (passing battery reference tied only to maximum peak to valley height PV, Rzjis, and maximum waviness height Wmax—all *height* parameters and *not spacing* parameters); EX1008 (discussing Rz or “degree of mirror gloss of roughness surface” only).

Indeed, Dr. Randall acknowledges Fabian’s shortcomings. Discussing [1h], Dr. Randall states that “[a] surface profile can have the same surface roughness with a different number of PPC [R_{pc}].” EX1003, ¶117; Pet. 45. Dr. Randall

paraphrases, further distancing himself from his previous analysis that erroneously ties Rz to Pc, *see* EX1003, ¶¶81, 88-99,: “In other words, a surface profile can have the same R_{pc} value while having a different surface roughness Rz value, unless Rz value is significantly changed (e.g., to less than 1 μm) so as to significantly affect the number of peaks that cross the upper and lower criteria lines in determining Pc.” EX1003, ¶117. Dr. Randall’s admissions are fatal to Petitioner’s attempt to shoehorn Rz into a metric that can be used to derive Pc. This admission is not surprising given this was already explained during prosecution. EX1002, 29-33.

Petitioner also cites Dobashi’s (EX1007) Rz_{jis} and R_{sm} in the same way as Shinozaki’s Rz and S_m, Pet., 67, which are not tethered to Pc for the same reasons as above—Dobashi’s Rz_{jis} and R_{sm} cannot be used to determine Pc. *See* VII.D.2; EX1002, 29-33 (distinguishing Rz/Rz_{jis} from Pc during prosecution). Moreover, Dobashi’s Figures 5 and 6 are instructive, showing no peaks or valleys above or below 0.5 μm and thus having no qualifying peaks to even count.

In Ground 2, Petitioner also relies on Griesi’s (EX1015) Rz—again, just like Shinozaki’s Rz features. Pet., 57-58. For the same reasons, this is incorrect. *See* VII.D.2; EX1002, 29-33 (distinguishing Rz/Rz_{jis} from Pc during prosecution).

In sum, Ground 2 follows the same formula as Ground 1, Pet., 57-61, pointing to Petitioner’s same, faulty assumptions—and thus Ground 2 similarly

fails. *See* Section VII.D.1-VII.D.2.

E. The claims require that both the first and second surfaces meet the claimed peak count Pc, but the art only considers the roughness of a single surface.

The Pc element [1g] (and [6c]/[10b]) require *each* of the first *and* second surfaces to have a peak count Pc of 3 to 92. This is not disclosed by Petitioner's art. And Petitioner fails to show this feature would have been obvious. Petitioner's art does not address Pc, Pc cannot be obtained from other surface roughness parameters, and Pc was not a recognized result-effective variable. *See* Section VII.D. So it follows that none of Petitioner's art renders obvious the claimed Pc feature specifying the Pc range as the claims' limitations require for *each surface* as required by the '689 patent's claims. Petitioner fails to explain why POSA to have modified the references to arrive at the claimed Pc features for *each side* of a copper foil, contravening *KSR*'s requirements. *KSR*, 550 U.S. at 418 (citation omitted); *see* Pet., 35, 44, 67-69.

A skilled artisan generally does not depart from or modify a method that works as intended absent a specific teaching that doing so would satisfy an unmet need or overcome an identified deficiency. *See In re Rosuvastatin Calcium Patent Litig.*, 703 F.3d 511, 517-18 (Fed. Cir. 2012) ("obviousness is not shown when what was obvious to try was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only

general guidance as to the particular form of the claimed invention or how to achieve it.”) (internal quotes omitted); *Yamanouchi Pharm. Co. v. Danbury Pharmacal, Inc.*, 231 F.3d 1339, 1345 (Fed. Cir. 2000) (affirming nonobviousness on the basis that prior art provided no motivation to modify existing compounds to obtain the invention, where challenger showed only that the skilled artisan would have expected similar results).

Petitioner provides *no sufficient reason* to modify the art’s respective approaches. Shinozaki applies similar Rz and Ra characteristics, which as Patent Owner demonstrated above do not correlate to Pc as the claims’ limitations require, let alone a Pc as the claims’ limitations require for both sides of a copper foil. EX1004, Abstract, ¶¶29, 31, 32, 73, 74; *see* Section VII.D.

Griesi, at best, has a passing reference to “RPc” with no discussion at all of what that is, let alone how it is measured. Even assuming that “RPc” is the claimed Pc measured under the claimed conditions, Griesi is still deficient because it relates only to a single side. *See, e.g.*, EX1015, 28-29, 54). Indeed, Griesi explains that roughness characteristics of the shiny side of copper foil are different from the matte side, and that *several factors contribute to this*, further undermining Petitioner’s assumption that the alleged Pc value applies to both sides:

The surface roughness of the matte side is determined by how uniformly the copper grows outward from the drum. Several factors contribute to this surface such as the flatness of the base (i.e. the drum),

the purity of the copper sulfate (CuSO_4), the uniformity of the electric field, the pH and temperature of the solution, and the time allowed for growth as determined by the electrodeposition over potential and current. Since so many factors are associated with determining surface of the matte or “high profile” side of the ED foil, it usually has a larger deviation in the z-axis height typically ranging from 2-25 μm (Figure 2.9).

EX1015, 28-29. Thus, Griesi demonstrates that such roughness differences are expected, and explains the difficulty with which to control such characteristics on one side, let alone two.

For at least these reasons, Petitioner fails to show that it would have been obvious for *both of the first and second* surfaces to have the claimed peak count Pc of 3 to 92, where the art only considers the roughness of a single surface.

VIII. Conclusion

The Petition fails to demonstrate a reasonable likelihood that any of the challenged claims is unpatentable as obvious in view of the cited art and, therefore, the Board should deny institution.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))

1. This Patent Owner Preliminary Response complies with the type-volume limitation of 14,000 words, comprising 13,030 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

2. This Patent Owner Preliminary Response complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman font.

Respectfully submitted,

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CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e))

I certify that the above-captioned **PATENT OWNER PRELIMINARY RESPONSE UNDER 37 C.F.R. § 42.107(a) and associated Exhibits 2001-2011, 2013-2015, 2017-2018** were served in their entireties on January 24, 2025, upon the following parties via electronic mail:

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