

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.

IPR2024-01463
Patent 11,591,706 B2

Before JO-ANNE M. KOKOSKI, JON B. TORNQUIST, and
DAVID COTTA, *Administrative Patent Judges*.

COTTA, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

On September 20, 2024, Solus Advanced Materials Co., Ltd. (“Petitioner”)¹ filed a Petition to institute *inter partes* review of claims 1–10 of U.S. Patent No. 11,591,706 B2 (Ex. 1001, “the ’706 patent”). Paper 2 (“Pet.” or “Petition”). SK nexilis, Co., Ltd. (“Patent Owner”)² filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply to Patent Owner’s Preliminary Response (Paper 9, “Prelim. Reply”) and Patent Owner filed a Sur-reply in support of the Preliminary Response (Paper 10, “Prelim. Sur-reply”). We also authorized the parties to file supplemental briefing addressing the impact of *Motorola Solutions, Inc. v. Stellar, LLC*, IPR2024-01205, Paper 19 (PTAB, Mar. 28, 2025). Paper 12 (“PO Supp.”); Paper 13 (“Pet. Supp.”).

Under 35 U.S.C. § 314(a), *inter partes* review may not be instituted unless the Petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” Petitioner has established a reasonable likelihood of prevailing on its assertion that at least one of the challenged claims is unpatentable based on the grounds advanced here. We decline to deny the Petition on a discretionary basis as requested by Patent Owner. Thus, for reasons explained below, we institute *inter partes* review of claims 1–10 of the ’706 patent.

¹ Petitioner identifies itself as well as Volta Energy Solutions Canada Inc., Volta Energy Solutions Europe KFT, Volta Energy Solutions Hungary KFT, and Volta Energy Solutions S.A.R.L. as the real parties-in-interest. Pet. 72.

² Patent Owner identifies itself as the real party-in-interest. Paper 4, 2.

A. Related Matters

The parties identify *SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd. et al.*, Case 2-23-cv-00539 (E.D. Tex.) (“Related Litigation”), filed November 21, 2023, as a related matter. Pet. 73; Paper 4, 1. Patent Owner also identifies IPR2024-01460, IPR2024-01461, IPR2024-01462, and IPR2025-00005 as administrative matters which “may affect or be affected by a decision in this proceeding.” Paper 4, 2.

B. The ’706 patent

The ’706 patent’s disclosure “relates to an electrolytic copper foil, and more particularly to an electrolytic copper foil exhibiting excellent handling characteristics in a process of manufacturing a copper foil and a subsequent process of manufacturing a secondary battery.” Ex. 1001, 1:19–23.

According to the ’706 patent, “the demand for lithium secondary batteries has abruptly increased” due to “increased use of portable electronic devices, such as mobile phones and laptop computers, and the propagation of hybrid electric vehicles.” *Id.* at 1:27–30. Lithium secondary batteries use an electrolytic copper foil mainly for the material of a negative electrode current collector. *Id.* at 1:31–33. If “production conditions are not precisely controlled at the time of manufacturing the electrolytic copper foil, a large number of curls, wrinkles, or tears” may occur and “are a prime cause of increased manufacturing costs” and “deterioration of the quality of lithium secondary batteries and of the increase in total quality-control expenses.” *Id.* at 1:35–44.

According to the ’706 patent, the disclosed invention “provide[s] an electrolytic copper foil configured such that the possibility of the electrolytic

copper foil being curled, wrinkled, and/or torn is reduced in a process of manufacturing the electrolytic copper foil and/or a subsequent process of manufacturing a secondary battery.” Ex. 1001, 1:65–2:3. The electrolytic copper foil described in the ’706 patent achieves such results because it has “a controlled surface texture factor and a controlled surface shape factor.” *Id.* at 3:40–43. More specifically, the ’706 patent describes three properties (numbered in brackets in the passage quoted below) as providing advantageous properties:

an electrolytic copper foil having a first surface and a second surface, wherein **[1] the texture coefficient** of the (220) plane of the electrolytic copper foil is 0.4-1.32, **[2] the difference ($|\Delta(Rz/Ra)|$)** between Rz/Ra on the first surface and Rz/Ra on the second surface, of the electrolytic copper foil, is less than 2.42, and **[3] the difference ($|\Delta PD|$) in peak density (PD)** between the first surface and the second surface, of the electrolytic copper foil, is 96 ea or less.

Id. at code (57) (bracketed numbers and emphasis added).

With respect to texture coefficient, the ’706 patent discloses that when the “(220) texture coefficient is less than 0.40 . . . , the crystal texture of the copper foil is not dense” and is “deformed by stress and heat applied thereto in a battery manufacturing process” causing “wrinkles . . . in the copper foil.” *Id.* at 4:12–17. Conversely, when the “(220) texture coefficient is greater than 1.32, the texture of the copper foil is excessively dense,” making the “copper foil . . . brittle” and causing it to tear during the battery manufacturing process. *Id.* at 4:17–21.

With respect to $\Delta Rz/Ra$ and ΔPD , the ’706 patent discloses that “curls are formed in the electrolytic copper foil due to the difference in the surface

properties between the opposite surfaces of the electrolytic copper foil” if “ $|\Delta(Rz/Ra)|$ and $|\Delta PD|$ at the opposite surfaces of the electrolytic copper foil deviate from the above numerical ranges [less than 2.42 for $\Delta Rz/Ra$ and 96 ea or less for $\Delta PD]$ ”. *Id.* at 4:36–41.

C. Challenged Claims

The '706 patent includes 10 claims, all of which are challenged in the Petition. Claim 1 is representative and reads as follows:

1. An electrolytic copper foil having a first surface and a second surface, wherein
 - a texture coefficient of (220) plane of the electrolytic copper foil defined by Equation 1 below is 0.4 to 1.32,

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

- a difference ($|\Delta(Rz/Ra)|$) between Rz/Ra at the first surface of the electrolytic copper foil and Rz/Ra at the second surface of the electrolytic copper foil is less than 2.42, and

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

Ex. 1001, 11:44–12:8.

D. Technological Background Regarding Claimed Properties

The challenged claims recite an electrolytic copper foil having three properties: 1) the 220 plane of the claimed foil has a texture coefficient (“TC (220)”) between 0.4 to 1.32; 2) the difference between Rz/Ra of a first and

second surface of the foil (“ $\Delta R_z/R_a$ ”) is less than 2.42; and 3) the difference between the peak density of a first and second surface of the foil (“ ΔPD ”) is 96 ea or less. Ex. 1001, 11:44–12:8. Before considering whether the cited art discloses or suggests a foil having these characteristics, we provide a brief overview of each of these characteristics.

1. Texture coefficient (220) (“TC (220)”)

“The texture coefficient (TC) of a crystal plane is a measure of the prominence (or relative intensity) of the X-ray diffraction (XRD) peak corresponding to the plane, relative to other planes.” Ex. 1003 ¶ 14. In an XRD analysis, X-rays “are projected toward a sample over a range of angles . . . and the diffracted X-rays are collected at the detector.” *Id.*

“[C]onstructive (and destructive) interference of the X-rays reflecting off different crystal planes in the sample result in higher (or lower) detected intensities respectively at certain angles.” *Id.* ¶ 15. “Peaks in the intensity vs. angle plot correspond to certain planes in the crystal structure of the sample, and the relative height of the corresponding peak intensity corresponds to the prominence (or relative concentration) of the crystal plane of interest within . . . the sample.” *Id.* ¶ 17.

The ’706 patent defines the texture coefficient of (220) plane of the electrolytic copper foil by Equation 1, which is reproduced below.

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

Ex. 1001, 2:10–23. In Equation 1, “ $I(hkl)$ indicates the XRD diffraction intensity of (hkl) crystal plane of a sample, and $I_0(hkl)$ indicates the diffraction intensity of (hkl) crystal plane of standard copper powder, set forth by the Joint Committee on Powder Diffraction Standards (JCPDS) (X-ray light source: $\text{Cu K}\alpha_1$).” *Id.* at 3:58–63. “1 to n indicate[s] the number of diffraction peaks within a specific range of diffraction angle 2θ .” *Id.* at 3:63–65. According to the ’706 patent, “the texture coefficient is obtained from an X-ray diffraction pattern within a range of diffraction angle 2θ between 30 degrees and 95 degrees, and remarkable crystal planes that are considered are (111), (200), (220), and (311) planes (that is, $n=4$).” *Id.* at 3:65–4:2.

2. Ten-point average roughness (R_z) and arithmetical average roughness (R_a)

According to the ’706 patent, “ R_z indicates ten-point average roughness, and R_a indicates arithmetical average roughness”, which “may be measured according to JIS B 0601(2001) standards.” *Id.* at 4:26–35.

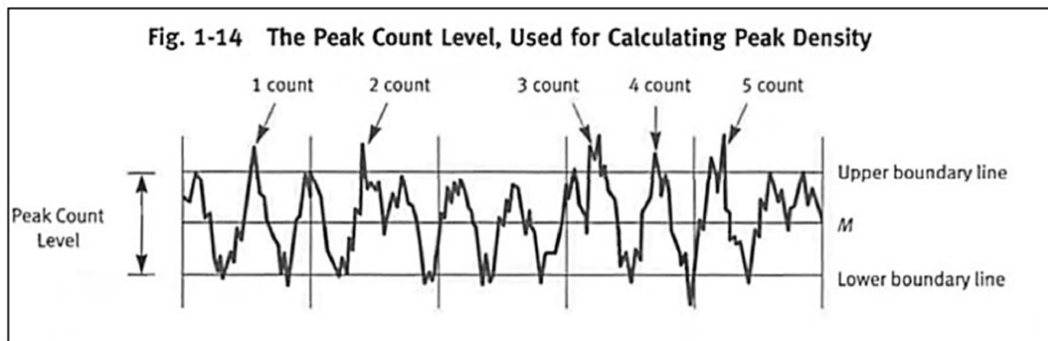
R_a may be calculated by first taking a profilometry measurement in which “a contacting probe is scanned across the surface of a sample” where the “vertical deflection of the probe is indicative of the underlying topography of the sample.” Ex. 1003 ¶ 20. “Mathematically, R_a is calculated by integrating the absolute value of the ‘height of the assessed profile’ ‘ $Z(x)$ ’ over the measurement length, and dividing by the measurement length.” *Id.* ¶ 21. “Conceptually, R_a is a simple, basic measure of surface roughness: higher R_a values indicate overall higher roughness.” *Id.* ¶ 22.

Rz may be calculated as “the sum of the mean of the profile peaks from the highest to fifth [highest] and the mean of the profile depth from the deepest valley to the fifth deepest valley.” *Id.* ¶ 23. Thus, “unlike Ra, which is concerned with the average roughness of the surface as a whole, Rz provides a measure indicative of the five highest and five lowest points, reflecting the most extreme aspects of the profile.” *Id.*

3. Peak density (PD)

The '706 patent teaches that “PD may be measured according to ASME B46.1 standards.” *Id.* at 4:33–35. According to Petitioner’s declarant, Dr. Randall, the relevant ASME standard is “not ‘PD’ but ‘Pc: the number of SAE peaks per unit length measured at a specified peak count level over the evaluation length.’” Ex. 1003 ¶ 24. Dr. Randall further explains that the same ASME standard specifies that “an ‘SAE peak’ is ‘a profile irregularity wherein the profile intersects consecutively a lower and an upper boundary line. . . set by a designer or an instrument operator for each application’” *Id.* ¶ 25. Thus, “in order to ‘count’ as a peak for purposes of calculating PD (or Pc), the measured profile must first pass below a lower boundary line, then pass above an upper boundary line (or vice versa).” *Id.* This is illustrated in Figure 1-14 (reproduced below) from

the ASME standard.



Ex. 1017, 10 (Fig. 1–14). Figure 1-14 includes three horizontal lines: a mean line, an upper boundary line, and a lower boundary line. *Id.* It depicts peak height relative to these three lines, labeling SAE peaks where the peak height crosses the upper boundary line and the lower boundary line in succession. *Id.* at 9. Figure 1-14 includes five SAE peaks, labeled “1-count,” “2-count,” “3-count,” “4-count,” and “5-count.” *Id.* With this information in mind, the PD of Figure 1-14 would be the number of SAE peaks (five) over the length of the surface measured.

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability in this Petition (Pet. 1–2):

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1A	1–5	103 ³	Kim ’761, ⁴ Cheng, ⁵ Wolski ⁶
1B	6	103	Kim ’761, Cheng, Wolski, Kim ’541 ⁷
1C	7	103	Kim ’761, Cheng, Wolski, Lee ⁸
1D	8–10	103	Kim ’761, Cheng, Wolski, Lee, Shinozaki ’681 ⁹

³ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103, and became effective on March 16, 2013. The earliest date to which ’706 patent claims priority is January 31, 2018. Ex. 1001, code (30). Because that date falls after the effective date of the applicable AIA amendments, we apply the AIA version of § 103 here.

⁴ Kim et al., Korean Patent Appl. Publ. No. 10-2017-0000761, published Jan. 3, 2017 (Ex. 1005, “Kim ’761”). Ex. 1005 is a certified English translation of Ex. 1004. *See* Ex. 1005, 16.

⁵ Cheng et al., U.S. Patent No. 9,209,485 B2, issued Dec. 8, 2015 (Ex. 1007, “Cheng”).

⁶ Wolski et al., U.S. Patent No. 5,834,140, issued Nov. 10, 1998 (Ex. 1008, “Wolski”).

⁷ Kim et al., U.S. Patent No. 9,457,541 B2, issued Oct. 4, 2016 (Ex. 1009, “Kim ’541”).

⁸ Lee et al., U.S. Patent Appl. Publ. No. 2016/0260981 A1, published Sep. 8, 2016 (Ex. 1010, “Lee”).

⁹ Shinozaki et al., WO 2014/115681 A1, published Jul. 31, 2014 (Ex. 1012, “Shinozaki ’681”). Ex. 1012 is a certified English translation of Ex. 1011. *See* Ex. 1012, 3, 45. Ex. 1012 has two sets of page numbers. When we refer to page numbers of Ex. 1012, we refer to the lowermost number at the bottom of each page.

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1E	10	103	Kim '761, Cheng, Wolski, Lee, Shinozaki '681, Dobashi ¹⁰
2A	1–5	103	Dobashi, Shinozaki '922, ¹¹ Chou ¹²
2B	6	103	Chou, Shinozaki '922, Dobashi, Kim '541
2C	7	103	Chou, Shinozaki '922, Dobashi, Lee
2D	8–10	103	Chou, Shinozaki '922, Dobashi, Lee, Shinozaki '681

Petitioner relies on the declaration of Dr. Michael Randall, among other evidence. Ex. 1003.

II. DISCRETIONARY DENIAL IN VIEW OF PARALLEL LITIGATION

Institution of an *inter partes* review is discretionary. *See* 35 U.S.C. § 314(a) (authorizing institution of an *inter partes* review under particular circumstances, but not requiring institution under any circumstances); *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 273 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *SAS Inst. Inc. v. Iancu*, 584 U.S. 357, 365–66 (2018).

In its Preliminary Response, Patent Owner contends that we should exercise our discretion to deny the Petition in view of the Related Litigation.

¹⁰ Dobashi et al., U.S. Patent No. 8,715,836 B2, issued May 6, 2014 (Ex. 1014, “Dobashi”).

¹¹ Shinozaki et al., U.S. Patent Appl. Publ. No. 2013/0108922 A1, published May 2, 2013 (Ex. 1015, “Shinozaki '922”).

¹² Chou et al., U.S. Patent Appl. Publ. No. 2015/0267313 A1, published Sept. 24, 2015 (Ex. 1016, “Chou”).

Prelim. Resp. 9–17.

When determining whether to exercise discretion to deny institution in view of a parallel proceeding, we consider the following factors:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board’s exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). “These factors relate to whether efficiency, fairness, and the merits support the exercise of authority to deny institution in view of an earlier trial date in the parallel proceeding.” *Id.* In evaluating these factors, we “take[] a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Id.* at 6. We consider each of these factors below.

For the reasons discussed below, we conclude that *Fintiv* factors 1 and 3 are neutral, factors 2 and 5 weigh in favor of denial (with factor 2 weighing strongly in favor of denial), and factors 4 and 6 weigh against discretionary denial (with factor 6 weighing strongly against denial).

A. Likelihood of a Stay (Factor 1)

Fintiv factor 1 recognizes that a stay of litigation pending resolution

of the PTAB trial allays concerns about inefficiency and duplication of efforts, which strongly weighs against exercising the authority to deny institution. *Fintiv*, Paper 11 at 6.

Both Petitioner and Patent Owner agree that this factor is neutral because a motion to stay has been filed in the Related Litigation, but the motion is still pending and “the Board should not speculate whether the court would grant a stay in the event this proceeding were instituted.” Prelim. Resp. 9–10; *see also* Prelim. Reply 1; Prelim. Sur-reply 1.

Absent specific evidence, the Board, typically, “will not attempt to predict how the district court in the related district court litigation will proceed because the court may determine whether or not to stay any individual case . . . based on a variety of circumstances and facts beyond our control and to which the Board is not privy.” *Sand Revolution II LLC v. Cont’l Intermodal Grp.*, IPR2019-01393, Paper 24, 7 (PTAB June 16, 2020) (informative). We decline to speculate on how the court may rule on the pending motion to stay. Accordingly, this factor is neutral.

B. Proximity of Trial Date to Projected Deadline (Factor 2)

Fintiv factor 2 looks to the “proximity of the court’s trial date to the Board’s projected statutory deadline.” *Fintiv*, Paper 11 at 9. “If the court’s trial date is at or around the same time as the projected statutory deadline . . . the decision whether to institute will likely implicate other factors.” *Id.* Conversely, “[i]f the court’s trial date is earlier than the projected statutory deadline,” this has generally weighed “in favor of exercising authority to deny institution.” *Id.*

Jury selection in the Related Litigation is scheduled to begin

November 3, 2025. Ex. 2005, 1. This predates the statutory deadline for issuing a Final Written Decision by approximately six months. Petitioner argues that Factor 2 is neutral given the backlog of cases in the Eastern District of Texas. Prelim. Reply 1 (citing increase in median time-to-trial from 21.9 to 23.0 months). But the updated median time-to-trial only pushes the expected trial date forward to mid-October 2025, which is still well before the statutory deadline.

Petitioner argues that its Motion to Transfer would “help ensure that the FWD outpaces any trial date” if granted. Pet. 71. As with Petitioner’s pending motion to stay, however, we decline to speculate on how the district court might rule on Petitioner’s motion to transfer. *Samsung Display Co., Ltd. v. Pictiva Displays Int’l Ltd.*, IPR2024-00855, Paper 12 at 8-9 (P.T.A.B. Nov. 19, 2024) (declining to speculate how the district court might rule on pending motions).

Accordingly, this factor weighs strongly in favor of exercising our discretion to deny institution.

C. Investment in the Parallel Proceeding (Factor 3)

Fintiv factor 3 considers the “investment in the parallel proceeding by the court and parties,” including “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*, Paper 11 at 9. For example, if, at the time of institution, the court in the parallel proceeding has issued “substantive orders related to the patent at issue in the petition” or “claim construction orders” this favors denial. *Id.* at 9–10.

Petitioner asserts that it “diligently filed this Petition months ahead of

the one-year timebar, while the EDTX litigation is still in its early stages and the parties and the court have yet to expend significant resources on invalidity.” Pet. 71. According to Petitioner, as of the deadline for issuing this Decision, “there will have been no court issued substantive orders related to the ’706 Patent,” and the Petition was filed “within four months of [Patent Owner’s] amended complaint.” Prelim. Reply 1. Finally, Petitioner points out that by the deadline for issuing this Decision, “fact discovery will . . . remain open.” Prelim. Reply 1.

Patent Owner points out that as of the issuance of this Decision, the parties will have exchanged invalidity and infringement contentions, briefed claim construction, and exchanged over 5,000 documents. Prelim. Resp. 13. According to Patent Owner, Petitioner did not act diligently, waiting until “ten months after the complaint was filed, and seven months after the . . . order noting Petitioner’s waiver of foreign service.” *Id.* at 14; Prelim. Sur-reply 2 (“The ’706 patent was asserted in the *original complaint* filed ten months before the Petition.”).

We find that investment in the Related Litigation has been modest. The parties have exchanged contentions and briefed claim construction, but fact discovery will not close until June 4, 2025 and, in this proceeding, neither party identifies claim terms that it contends merit construction. While the parties appear to have invested some effort in the Related Litigation, the bulk of the investment from the court and the parties appears to lie ahead. Petitioner’s diligence in filing its Petition weighs neither for nor against exercising our discretion. Overall, we determine that this factor is neutral.

D. Overlap of Issues (Factor 4)

Fintiv factor 4 considers whether “the petition includes the same or substantially the same claims, grounds, arguments, and evidence as presented in the parallel proceeding.” *Fintiv*, Paper 11 at 12. If the issues in the Petition overlap substantially with those raised in the parallel proceeding, “this fact has favored denial.” *Id.* “Conversely, if the petition includes materially different grounds, arguments, and/or evidence . . . this fact has tended to weigh against exercising discretion to deny institution.” *Id.* at 12–13.

Here, Petitioner stipulates that “should the Petition be granted, Petitioner will not pursue in the parallel district court proceeding the same grounds as in this Petition or any grounds that could have reasonably been raised in this Petition pursuant to *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020).” Prelim. Reply 1–2.

In its Supplemental Brief, Patent Owner contends that, similar to the petitioner in *Motorola Solutions, Inc. v. Stellar, LLC*, IPR2024-01205, Paper 19 at 2–4 (PTAB Mar. 28, 2025), “Petitioner’s invalidity contentions include combinations of the asserted art with other system art, ‘which Petitioner’s stipulation is not likely to moot.’” PO Supp. 1 (citing *Motorola*, Paper 19 at 4; Ex. 2010, 7–8, 52). Petitioner disputes this, asserting that Patent Owner relied on outdated invalidity contentions and that its amended invalidity contentions are “entirely different from those at issue here.” Pet. Supp. 1.

Sotera is binding precedent and indicates that a *Sotera* stipulation weighs strongly against exercising discretion to deny institution. *Sotera*, Paper 12 at 19. The Director’s decision in *Motorola* explains that a *Sotera*

stipulation that does not moot all invalidity issues before the district court, such as invalidity assertions based on combinations of art with “unpublished systems prior art,” is less effective and will not necessarily outweigh other *Fintiv* factors that favor discretionary denial. *Motorola*, Paper 19 at 3–4.

Here, in view of Petitioner’s *Sotera* stipulation, we find that this factor weighs against exercising our discretion to deny institution.

E. Identity of Parties (Factor 5)

The parties in the Related Litigation are the same. Pet. 71. To the extent that trial in the district court may precede the deadline for a final written decision in this proceeding, this factor favors exercising our discretion to deny institution. *Huawei Tech. Co. v. WSOU Inv., LLC*, IPR2021-00225, Paper 11 at 14 (PTAB June 14, 2021) (finding that “this factor favors denial if trial precedes the Board’s Final Written Decision and favors institution if the opposite is true”) (internal quotation marks omitted); *Google LLC v. Parus Holdings, Inc.*, IPR2020-00846, Paper 9 at 21 (PTAB Oct. 21, 2020) (“Here, . . . Petitioner is the defendant in the parallel proceeding. This fact could weigh either in favor of, or against, exercising discretion to deny institution, depending on which tribunal was likely to address the challenged patent first.”). As discussed *supra* § II.B, trial in the district court is likely to precede our final written decision. Accordingly, this factor weighs in favor of exercising our discretion to deny institution.

F. Other Circumstances Including the Merits (Factor 6)

Fintiv factor 6 looks to whether other circumstances exist that impact the Board’s exercise of discretion, including the merits. *Fintiv*, Paper 11 at

14–15. One factor we may consider is the strength of Petitioner’s showing. *Id.* at 14–15. If the merits “seem particularly strong on the preliminary record, this fact has favored institution,” whereas “if the merits of the grounds raised in the petition are a closer call, then that fact has favored denying institution when other factors favoring denial are present.” *Id.*

Petitioner argues that it “presents a compelling case of invalidity,” and that this weighs against exercising our discretion to deny institution. Pet. 71; Prelim. Reply 2. Patent Owner argues that “Petitioner’s asserted grounds fall well short of meeting even the reasonable likelihood standard necessary for institution.” Prelim. Sur-reply 3. More specifically, Patent Owner argues that Petitioner “fails to demonstrate: (1) a reasonable expectation of success in combining the three-reference combinations in Grounds 1A and 2A and (2) fails to show how the Ground 2A combination discloses the PD limitation of the claims.” Prelim. Resp. 16–17.

We discuss Petitioner’s patentability challenge in detail *infra* Section III. For the reasons discussed *infra* Section III.E, we find that Petitioner’s Ground 1A presents a particularly strong patentability challenge.¹³ Accordingly, we find that factor 6 weighs strongly in favor of institution.

¹³ Petitioner includes arguments directed to the merits of the asserted grounds in its discussion of Factor 6 in its authorized Preliminary Reply. See Prelim. Reply 2–5. Patent Owner argues that Petitioner requested authorization to file a reply to Patent Owner’s Preliminary Response to address “developments that have occurred after petition filing,” but instead used its Reply to “make[] technical argument” and “fill gaps in its Petition.” Prelim. Sur-reply 1. Patent Owner asserts that we “should not entertain such gamesmanship and should disregard Petitioner’s Reply.” *Id.* We do not rely

G. Balancing the Factors

When considering the *Fintiv* factors, we take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Fintiv*, Paper 11 at 6. For the reasons discussed above, *Fintiv* factors 1 and 3 are neutral; *Fintiv* factors 2 and 5 weigh in favor of discretionary denial (with factor 2 weighing strongly in favor of denial); and *Fintiv* factors 4 and 6 weigh against discretionary denial (with factor 6 weighing strongly against denial). Weighing these various factors, and in particular the strength of Petitioner’s showing on Ground 1A, we determine that the evidence of record weighs against discretionary denial.

Accordingly, we decline to exercise our discretion under 35 U.S.C. § 314(a) to deny institution of *inter partes* review.

III. PATENTABILITY ANALYSIS

A. Principles of Law

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented and the prior art are such

on any substantive arguments made by Petitioner in its Preliminary Reply in making our determination below that Petitioner has presented a likelihood of success on the merits (*see infra* Section III).

that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which that subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective indicia of nonobviousness when presented.¹⁴ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Skill in the Art

In determining the level of skill in the art, we consider the problems encountered in the art, the art’s solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986).

Petitioner contends that a person of ordinary skill in the art (“POSA”) would have had at least an undergraduate degree in materials science, chemical engineering, electrical engineering, or related field, or equivalent knowledge, training, or experience, with at least two years of experience working on the development of materials or components for electronic devices such as batteries. Additional education can compensate for less work experience, and vice-versa.

¹⁴ The current record in this proceeding does not include any argument or evidence directed to objective indicia of nonobviousness.

Pet. 5–6 (citing Ex. 1003 ¶¶ 11–12).

At this stage of the proceeding, Patent Owner does not contest Petitioner’s definition of the level of skill in the art. Prelim. Resp. 4 (“For purposes of this Preliminary Response, Patent Owner applies Petitioner’s level of skill for a person of ordinary skill in the art”).

Petitioner’s definition appears to be consistent with the field of the invention reflected in the prior art of record and the disclosure of the ’706 patent. Accordingly, for purposes of this Decision, we adopt Petitioner’s proposed definition of the person of ordinary skill in the art.

C. Claim Construction

We interpret a claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b) (2023). Under this standard, we construe the claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*

Petitioner asserts that “no formal claim constructions are necessary in this proceeding.” Pet. 6.

Patent Owner asserts that “[t]he Board need not construe any term in order to determine that institution should be denied.” Prelim. Resp. 4.

We determine that no terms require express construction at this stage. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Overview of Asserted Prior Art Relevant to Disputed Issues

1. Kim '761 (Ex. 1005)

Kim '761 is a Korean Patent Application Publication relating to an electrolytic copper foil for secondary batteries. Ex. 1005, codes (11), (12), (19), (54), (57). It published on January 3, 2017. *Id.* at code (43). Petitioner contends that Kim '761 is prior art under 35 U.S.C. § 102(a)(1). Pet. 2. According to Kim '761, “[i]n general, in a lithium secondary battery, an aluminum foil is used as a cathode current collector coupled to a cathode active material and a copper foil is used as an anode current collector coupled to an anode active material.” Ex. 1005 ¶ 27. Kim '761 describes “an electrolytic copper foil which can secure secondary batteries with high capacity maintenance, a current collector including the same, an electrode including the same, a secondary battery including the same, and a method for manufacturing the same.” *Id.* at code (57).

Kim '761 discloses that its electrolytic copper foil includes “a first surface; and a second surface opposite to the first surface, wherein each of the first and second surfaces has a peak count roughness R_{pc} of 10 to 100”. Ex. 1005 ¶ 14. The first surface “contacts the rotational anode drum in the process of electroplating” and is also called a “shiny surface.” *Id.* ¶ 30. The second surface is opposite to the first surface and is also called a “matte surface.” *Id.* According to Kim '761, “the peak count roughness R_{pc} of each of the shiny surface . . . and the matte surface . . . of the electrolytic copper foil . . . means an average of peak count roughness R_{pc} values obtained at three random points.” *Id.* ¶ 41. “[T]he peak count roughness R_{pc} of each point is the number of effective peaks P_1, P_2, P_3, P_4 which rise above an

upper criteria line C1 of 0.5 μm per unit sampling length of 4 mm in the surface roughness profile obtained according to steel-iron test schedule (SEP 1940).” *Id.* Kim ’761 states that “[i]f there is no valley deeper than the lower criteria line C2 of -0.5 μm between adjacent peaks rising above the upper criteria line C1,” then “the adjacent peaks cannot be ‘effective peaks’ used for measurement of the peak count roughness R_{pc} and [the] relatively lower one is excluded in determining the number of ‘effective peaks’.” *Id.*

2. Cheng (Ex. 1007)

Cheng is a United States patent entitled “Electrolytic Copper Foil,” that issued on December 8, 2015. Ex. 1007, codes (12), (45), (54). Petitioner contends that Cheng is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 2. Cheng concerns “electrolytic copper foils, and more particularly, [] an electrolytic copper foil applicable to a charging-discharging battery.” Ex. 1007, 1:15–17.

Cheng describes an electrolytic copper foil with “a shiny side and a matte side with a roughness of less than 2 μm .” Ex. 1007, code (57). According to Cheng,

the electrolytic copper foil is manufactured by using the aqueous solution consisting of sulfuric acid and copper sulfate as an electrolyte, using a titanium plate coated by iridium element or iridium oxide as a dimensionally stable anode (DSA), using a titanium drum as a cathode, applying direct current between two electrodes to electrodeposit copper ions from the electrolyte on the titanium drum, peeling off the electrolytic copper foil from the surface of the titanium drum and continuously winding.

Id. at 1:51–59. “The surface of the electrolytic copper foil that is contacting the surface of the titanium drum is called ‘shiny side (S side),’ and the other

side is called ‘matte side (M side).’” *Id.* at 1:59–62. Cheng reports that “the sum of the texture coefficients of the (220) surface and the (311) surface of the electrolytic copper foil is greater than 60%”, “[b]ased on the total sum of the texture coefficients of a (111) surface, a (200) surface, a (220) surface and a (311) surface of the electrolytic copper foil.” *Id.* at code (57).

3. Wolski (Ex. 1008)

Wolski is a United States patent relating to an electrodeposited copper foil capable of making a fine pattern and capable of obtaining a high etching factor. Ex. 1008, 1:7–11, codes (11), (19), (54). It issued on November 10, 1998. *Id.* at code (45). Petitioner contends that Wolski is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 2. Wolski discloses that “the untreated copper foil according to [Wolski’s] invention has flatter surfaces on both surfaces as compared with the conventional ones so that it can be used as an electrode material for a secondary battery, a flat cable, a shielding material for covering cables and other [uses].” Ex. 1008, 1:12–18.

Wolski explains that its electrodeposited copper foil “comprises an untreated copper foil having a shiny side and a matte side” in which “a surface roughness R_z of the matte side is the same as a surface roughness R_z of the shiny side or less and the matte side is subjected to a surface bond enhancing treatment.” Ex. 1008, 4:57–62. According to Wolski, “the surface roughness R_z means a ten-point mean roughness (R_z) . . . according to ‘JIS B 0601-1994.’” *Id.* at 4:62–65.

Wolski discloses a method for producing electrodeposited copper foil using “an additive which is a base of a combination is 3-mercapto 1-propanesulfonate as a compound having a mercapto group,” in combination

with another organic compound such as a high molecular weight polysaccharide. Ex. 1008, 4:66–5:1, 5:7–10, 5:18–20. “By using the above organic compound in combination with 3-mercapto 1-propanesulfonate, copper crystal can be made fine and a plating surface having less unevenness can be obtained.” *Id.* at 5:30–33. Additionally, “the organic compound has an action of preventing a produced copper foil from being fragile” by “alleviat[ing] inner stress accumulated in the copper foil so that the organic compound not only prevents breaking and curling of the copper foil occurring when the copper foil is wound from a cathode drum, but also improves elongations at room temperature and high temperature.” *Id.* at 5:34–41.

4. Kim ’541 (Ex. 1009)

Kim ’541 is a United States patent relating to a copper foil for a current collector of a lithium secondary battery. Ex. 1009, codes (12), (54), (57). It issued on October 4, 2016. *Id.* at code (45). Petitioner contends that Kim ’541 is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 2. Kim ’541 describes a copper foil with a crystalline structure in which: (1) “a ratio of the sum of texture coefficients of a (111) surface and a (200) surface to the total sum of texture coefficients of the (111), (200) and (220) surfaces is 60 to 85%”; (2) “a ratio of the texture coefficient of the (111) surface to the total sum of texture coefficients of the (111), (200) and (220) is 18 to 38%”; (3) “a ratio of the texture coefficient of the (200) surface thereto is 28 to 62%”; (4) “a ratio of the texture coefficient of the (220) surface thereto is 15 to 40%”; and (5) “[t]he copper foil has surface roughness (R_z -JIS) of 2 μm or less, weight deviation of 3% or less, tensile strength of 30 to 40

kgf/mm², elongation of 3 to 20%, and thickness of 1 to 35 μm .” Ex. 1009, code (57).

Kim ’541 discloses that its copper foil for a current collector of a lithium secondary battery “is made by adding a small amount of organic additives to a copper sulfate solution containing copper sulfate, sulfuric acid and chlorine” in which the additive may be (1) “a sulfonate-based additive containing sulfide as a brightener to polish a plating surface and obtain a fine plating layer”; (2) “gelatin having a low molecular weight of 1,000 to 100,000 as a leveler added to obtain a low roughness copper foil”; or (3) “a cellulose-based additive serving as a suppressor to realize a stable low roughness.” Ex. 1009, 3:8–18.

5. Lee (Ex. 1010)

Lee is a U.S. Patent Application Publication published on September 8, 2016. Ex. 1010, codes (12), (19), (43). Petitioner contends that Lee is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 2. Lee discloses “an electrodeposited copper foil, in which a center line roughness average R_a (μm), a maximum height R_{max} (μm), and a ten-point height average R_z (μm) of a matte side satisfy an Equation below, $1.5 \leq (R_{\text{max}} - R_z) / R_a \leq 6.5$.” Ex. 1010, code (57). Lee’s electrodeposited copper foil maintains low roughness and high strength, exhibits a high elongation rate, and has excellent glossiness “so that the electrodeposited copper foil may be used in a current collector of a medium and large lithium ion secondary battery and a semiconductor packaging substrate for Tape Automated Bonding (TAB) used in a Tape Carrier Package (TCP).” *Id.*

Lee’s electrodeposited copper foil has a corner curl angle of 0° to 45°,

which means that the angle at which an end portion (i.e., a corner or an edge) of “the electrodeposited copper foil is bent when the electrodeposited copper foil is laid on a flat floor” is 0° to 45°. Ex. 1010 ¶ 52. Lee explains that corner curling occurs when the internal energy of the electrodeposited copper foil is not uniform. If the corner curl angle is too large, it is difficult to use the electrodeposited copper foil in a subsequent process because “a plurality of defects, such as a torn corner, may be generated during a process, such as deposition, in a PCB process, and in a process of the lithium secondary battery, a corner may be torn or folded, or wrinkles may be generated during a coating of an active material.” *Id.* According to Lee, impurities exist within a copper crystal in its electrodeposited copper foil “so that strength of the electrodeposited copper foil is high, and thus it is expected that a degree of corner curling is large, but impurities do not exist in a copper grain boundary, so that internal stress is decreased and thus a degree of corner curl is decreased.” *Id.*

Lee explains that its “electrodeposited copper foil is obtained by extracting a copper foil on a surface of a negative electrode drum by supplying a current between a rotated negative electrode drum immersed in a bathtub of a copper electrolyte and a positive electrode, and a surface of the electrodeposited copper foil, which is in contact with the negative electrode drum”. Ex. 1010 ¶ 37. The shiny side of the electrodeposited copper foil is the side on which the foil is extracted, and the opposite surface of the shiny side is referred to as the matte side. *Id.* “[T]he matte side originally has low glossiness and high surface roughness”, so “a process of decreasing surface roughness and applying glossiness as necessary through a post-treatment is

performed on the matte side.” *Id.*

Lee’s method “includes electrolyzing a copper electrolyte including an additive A, an additive B, an additive C, and an additive D” wherein

the additive A is one or more selected from the group consisting of a thiourea-based compound and a compound, in which a thiol group is connected to a heterocycle including nitrogen, the additive B is a sulfone acid of a compound including a sulfur atom or metallic salt thereof, the additive C is a nonionic water soluble polymer, and the additive D is a *phenazinium*-based compound.

Ex. 1010 ¶ 73. Lee discloses that “a content of additive A is 1 to 10 ppm, a content of additive B is 10 to 200 ppm, a content of additive C is 5 to 40 ppm, and a content of additive D is 1 to 10 ppm.” *Id.* ¶ 75. These additives make it “possible to fabricate a thin, highly mechanically strong, highly elongated, and low rough copper foil.” *Id.* ¶ 74.

The copper electrolyte may also include chlorine ion in a concentration of 1 to 40 ppm. Ex. 1010 ¶ 74. “When a small amount of chlorine ions exists in the copper electrolyte, initial nucleation sites are increased during the electroplating,” which allows crystal grains to become fine, “and the extracted materials of CuCl_2 formed on an interface of a grain boundary suppress the crystal from being grown during the heating at a high temperature, thereby improving thermal stability at a high temperature.” *Id.* When the “concentration of chlorine ions is less than 1 ppm, a concentration of chlorine ions required in a sulfuric acid-copper sulphate electrolyte is short, so that tensile strength of the electrodeposited copper foil before a heat treatment may be degraded and thermal stability at a high temperature may be degraded.” *Id.* When the “concentration of chlorine ions is larger than

40 ppm, the surface roughness of the matte side is increased” such “that it is difficult to fabricate a low rough electrodeposited copper foil, tensile strength of the electrodeposited copper foil before a heat treatment may be degraded, and thermal stability at a high temperature may be degraded.” *Id.*

6. Shinozaki '681 (Ex. 1012)

Shinozaki '681 is an International Patent Application Publication published on July 31, 2014. Ex. 1012, codes (10), (12), (43). Petitioner contends that Shinozaki '681 is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 3. Shinozaki '681 discloses an “electrolytic copper foil and [a] method for producing same.” Ex. 1012, code (54). Shinozaki '681 discloses that an object of its invention “is to provide an electrolytic copper alloy foil that has a high mechanical strength under normal conditions, and that is resistant to thermal degradation of mechanical properties even when heated, for example, to the . . . high temperature of about 300°C”, and “to provide an electrolytic copper alloy foil with high conductivity, high tensile strength, and excellent heat resistance by incorporating into the electrolytic copper alloy foil a metal that was conventionally metallurgically impossible to form an alloy with copper.” *Id.* ¶ 35.

Shinozaki '681 discloses that its electrolytic copper alloy foil “contains metal that exists as an oxide in liquids with a pH of 4 or less” (such as W, Mo, Ti, or Te), “either as ultrafine particles of the oxide or as ultrafine particles of the reduced metal.” Ex. 1012 ¶ 39. Shinozaki '681 discloses that the amount of these metals incorporated into the electrolytic copper alloy foil is preferably 50 to 2200 ppm. *Id.* If the amount of metal is too low, “the effect of improving heat resistance is significantly reduced, and

the ratio of tensile strength measured at room temperature after heating at 300°C, for example, will degrade to less than 80% as compared to tensile strength under normal conditions.” *Id.* If the amount of metal is excessively high, the “effect of increasing tensile strength will be saturated and no further improvement is seen, but this is also undesirable because of high cost.” *Id.*

Shinozaki ’681 also discloses that its electrolytic copper alloy foil “contains chlorine in an amount exceeding 10 ppm and less than 50 ppm.” Ex. 1012 ¶ 39. “Excessively low chlorine content in the electrolytic copper alloy foil is undesirable because the selection of copper raw materials for use in manufacturing the copper foil by electrolysis will be stricter, and too many restrictions will be imposed on the manufacturing equipment.” *Id.* “[A]n excessively high chlorine content in the electrolytic copper alloy foil is undesirable because the amount of metal incorporated into the foil decreases, resulting in lower initial strength and strength after heating.” *Id.*

7. Dobashi (Ex. 1014)

Dobashi is a U.S. patent issued on May 6, 2014. Ex. 1014, codes (12), (45). Petitioner contends that Dobashi is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 3. Dobashi describes “a surface-treated electro-deposited copper foil having a bonding surface, to be bonded with an insulation layer-forming material, having small waviness that is excellent in fine pattern wiring forming performance when used for a printed wiring board and the like, and to a method for manufacturing the same.” Ex. 1014, 1:7–18. Dobashi discloses “the maximum waviness height (W_{max}) of the bonding surface to be bonded with an insulation layer-constituting material

to be 0.05 μm to 0.7 μm , the maximum peak to valley height (PV) to be 0.05 to 1.5 μm , and the surface roughness (R_{zjs}) to be 0.1 μm to 1.0 μm .” *Id.* at code (57).

8. Shinozaki '922 (Ex. 1015)

Shinozaki '922 is a U.S. Patent Application Publication published on May 2, 2013. Ex. 1015, codes (12), (19), (43). Petitioner contends that Shinozaki '922 is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2).

Pet. 3. Shinozaki '922 discloses an electrolytic copper foil and a lithium ion secondary battery which includes

a positive electrode, a negative electrode which is comprised of a negative electrode active material layer formed on the surface of a negative electrode current collector having a surface which is formed with uneven shapes, and a nonaqueous electrolyte; an electrode to be used in that secondary battery; and an electrolytic copper foil for lithium ion secondary battery collector which forms part of the collector of that electrode.

Ex. 1015 ¶ 2. According to Shinozaki '922, “no wrinkles are formed on the collector, the collector does not fracture, the adhesion between the active material and the collector is high, and stable performance can be maintained for a long period of time.” *Id.* at code (57).

Shinozaki '922 discloses using a roughening treatment by means of electrolysis to form “a surface-roughened layer of copper or copper alloy particles having a particle diameter of 0.1-3 μm ” on both surfaces of an untreated copper foil. Ex. 1015, code (57). “[T]he surface-roughened layers on both surfaces have a surface roughness R_z of 1.0-5 μm and a surface roughness R_a of 0.25-0.7 μm , with the R_z difference between the front and back surfaces being within 3 μm and the R_a differences between the front

and back surfaces being within 0.3 μm .” *Id.* According to Shinozaki ’922, “[t]he untreated copper foil is preferably comprised of a granular crystal” so that “the difference of roughening between the two surfaces in the state of the untreated copper foil can be made small and the difference of roughness after the roughening treatment can be made smaller.” *Id.* ¶ 48. “[I]f the untreated copper foil is comprised of a columnar crystal, the difference of roughness between the two surfaces in the state of the untreated copper foil becomes large, therefore it is difficult to eliminate that difference even after the roughening treatment is carried out.” *Id.*

9. Chou (Ex. 1016)

Chou is a U.S. Patent Application Publication published on September 24, 2015. Ex. 1016, codes (12), (19), (43). Petitioner contends that Chou is prior art under AIA 35 U.S.C. §§ 102(a)(1) and (2). Pet. 3. Chou discloses “electrodeposited copper foils, and more particularly, [] an electrodeposited copper foil suitable for use in a printed circuit board and rechargeable and discharge batteries”, such as lithium ion secondary batteries. Ex. 1016 ¶ 3; *see also id.* at code (57). Chou describes “[a]n electrodeposited copper foil having a texture coefficient of a plane (200) from 50 to 80%, based on the sum of the texture coefficients of a plane (111), the plane (200), a plane (220) and a plane (200) of the electrodeposited copper foil”. *Id.* at code (57).

E. Obviousness over the Combination of Kim '761, Cheng, and Wolski (Ground 1A)

1. Claim 1

Petitioner asserts that claim 1 would have been obvious over the combination of Kim '761, Cheng, and Wolski. Pet. 6–32. More specifically, Petitioner relies on Kim '761 as disclosing the claimed Δ PD, Cheng as disclosing the claimed TC(220), and Wolski as disclosing the claimed Δ Rz/Ra. *Id.* Petitioner asserts that each of these three references discloses one of the three claimed properties (Δ PD, TC(220), and Δ Rz/Ra) but is silent as to the other two properties. *Id.* at 12. At this stage in the proceeding, Patent Owner does not dispute that Kim '761, Cheng, and Wolski each disclose foils that have one of the three claimed properties. *See generally*, Prelim. Resp. We have reviewed Kim '761, Cheng, and Wolski as well as the testimony of Dr. Randall discussing these references and find that the preliminary record supports that they each disclose copper foils having one of the three claimed properties. We next consider whether Petitioner has established, sufficiently for institution, that it would have been obvious to make a foil having all three of the properties recited in claim 1.

Petitioner contends that it would have been obvious to combine the disclosures of Kim '761, Cheng, and Wolski, and that doing so renders obvious a copper foil having all three of the recited properties— Δ PD, TC(220), and Δ Rz/Ra. Petitioner's proposed combination begins with Kim '761. Petitioner contends that Kim '761 discloses the claimed Δ PD but acknowledges that Kim '761 does not disclose the claimed Δ Rz/Ra or TC(220). Pet. 11–13, 23–25. Although Petitioner recognizes that Kim '761

does not disclose $\Delta R_z/R_a$ or TC(220), Petitioner does not concede that Kim '761's foil would need to be "modified" in order to have those properties. *Id.* at 12. Petitioner asserts the challenged claims "rely on the relative obscurity of their measurements rather than on novel structures or methods," such that the "three specific material properties" recited in the claims "do not appear to have been measured (or were simply not mentioned) together in any single reference." *Id.* Notwithstanding its position that Kim '761 may not require modification, Petitioner asserts that "the prior art provides ample motivation and guidance for modifying Kim '761's copper foil to obtain the TC(220) and R_z/R_a values disclosed by Cheng and Wolski." *Id.* at 13.

As to the claimed TC(220), Petitioner contends that "Cheng recognizes that TC(220) is correlated with crystalline grain size and roughness." *Id.* (citing Ex. 1007, 2:30–35). According to Petitioner, Cheng teaches that "certain TC(220) values (in combination with TC(311) values) are associated with 'significantly increased' elongation and a low matte-side roughness" and that "[f]oils having the crystalline phase structure associated with the disclosed TC(220) values (in combination with TC(311) values) also have a 'roughness difference between both sides' that is 'extremely small [such that] it was thus not easy for the electrolytic copper foil to break or fracture.'" *Id.* (citing Ex. 1007, 4:18–28, 10:27–34). Petitioner thus contends that "Cheng provides a clear recognition of texture coefficients[,], including TC(220) as result-effective variables, such that it would have been obvious to a [POSA] to optimize TC220 by, for example, fabricating a

copper foil having the texture coefficients . . . that Cheng describes as providing effective results.” *Id.* at 13–14 (citing Ex. 1003 ¶ 68).

Petitioner contends that a POSA would reasonably have expected success in modifying Kim ’761 to have the claimed TC(220) value. Petitioner explains that Cheng discloses process parameters associated with the manufacture of its foils. *Id.* at 14 (citing Ex. 1007, 4:4–11, 4:40–59, 4:66–5:2, 5:11–18, Table 1). Petitioner then cites the testimony of Dr. Randall that “the electrodeposition process described by Cheng represents no great departure from that described in Kim ’761” in that “[t]he two references describe deposition at similar temperatures, using similar plating currents, in solutions composed primarily of similar amounts of copper ions and sulfuric acid.” *Id.* at 14–15 (citing Ex. 1003 ¶ 70). According to Petitioner and Dr. Randall, “[i]t would have been obvious to try slightly modifying Kim ’761’s solution by, for example, including the polyvinyl alcohol and/or small molecular weight glue incorporated into Cheng’s solution, to obtain Cheng’s TC(220) values.” *Id.* at 15 (citing Ex. 1003 ¶ 70).

As to the claimed $\Delta R_z/R_a$ between first and second surfaces of the copper foil, Petitioner contends that Wolski describes “the desirability of having ‘both surfaces of the untreated copper foil’ be ‘flat.’” Pet. 15 (citing Ex. 1008, 9:27–28, 12:22–23). More particularly, Petitioner cites Wolski’s teaching that it is desirable that “the surface roughness R_z at the matte side of the untreated copper foil [be] the same or smaller than the surface roughness R_z at the shiny side of said untreated copper foil so that the surface treated copper foil after subjecting to bond enhancing treatment onto

the matte side becomes more low-profiled one as compared with the conventional foil.” *Id.* (citing Ex. 1008, 6:36-42). According to Petitioner, “copper foils having the . . . Rz and Ra values [disclosed in Wolski] also exhibit ‘excellent’ ‘elongation characteristics’ and ‘high tensile strength’ and are, based on their surface roughness, particularly compatible with a subsequent bond enhancing treatment.” *Id.* (citing Ex. 1008, 9:28–29, 11:37–12:5, 12:16). Petitioner asserts that this “comports with a broad recognition in the art that similar surface profiles (e.g., roughness) between the matte side and the shiny side were desirable.” *Id.* at 16 (citing Ex. 1003 ¶ 72; Ex. 1007, 10:30–34; Ex. 1023, 3:14–15). Thus, Petitioner concludes, “roughness parameters such as Rz and Ra were well-established as result-effective, such that it would have been obvious to . . . optimize Rz and Ra by, for example, fabricating a copper foil having the Rz and Ra values, on both matte and shiny sides, disclosed by Wolski and known to provide good results.” *Id.* (citing Ex. 1003 ¶ 73). In optimizing Rz and Ra values, a POSA would, Petitioner asserts, have “also arrived at the Rz/Ra ratios disclosed by Wolski,” particularly because the art recognized that, for copper foil, higher Rz/Ra “indicat[es] increased non-uniformity.” *Id.* at 16–17 (citing Ex. 1025, 2; Ex. 1003 ¶ 74).

Petitioner contends that a POSA would reasonably have expected success in modifying Kim ’761 to have the claimed $\Delta Rz/Ra$ between first and second surfaces of the copper foil. Petitioner explains that Wolski discloses process parameters associated with the manufacture of its foils, including, specifically, the use of “3 mercapto 1-propanesulfonate (MPS) in combination with a ‘low molecular weight glue’ and a small amount of

chloride ions in order to obtain the disclosed roughness values.” Pet. 17 (citing Ex. 1008, 4:66–6:35, 6:52–7:3). According to Petitioner, and Dr. Randall, “Kim ’761 already discloses the inclusion of chlorine ions, and Cheng already discloses the inclusion of MPS and low molecular weight glue.” *Id.* (citing Ex. 1003 ¶ 75). Dr. Randall further testifies that “the electrodeposition temperature, current density, and primary solution components (copper ions, sulfuric acid) and proportions are the same or similar between Kim ’[76]1, Cheng, and Wolski,” and therefore, “[i]t would have been obvious to try slightly modifying Kim ’761’s solution by, for example, including the MPS, low molecular weight glue, and chlorine ions in the proportions disclosed by Wolski, to obtain Wolski’s R_z and R_a values.” *Id.* (citing Ex. 1003 ¶ 75).

Patent Owner disputes that Petitioner has articulated “sufficient motivation to combine the references . . . and/or a reasonable expectation of success in combining the cited references to arrive at what is claimed.” Prelim. Resp. 17. We have reviewed the evidence and arguments provided by the parties. The preliminary record supports that the POSA would have been motivated to modify Kim ’761’s copper foil such that it has the recited properties, and that the POSA would have had a reasonable expectation of success in doing so. We address Patent Owner’s arguments below.

Patent Owner argues that “Petitioner fails to articulate a sufficient motivation to combine the references.” Prelim. Resp. 17. Patent Owner does not further elaborate on why Petitioner’s articulated motivation is insufficient. On this preliminary record, the prior art cited by Petitioner appears to support that the POSA would have recognized that ΔPD ,

TC(220), and $\Delta R_z/R_a$ are result effective variables and that copper foils having ΔPD , TC(220), and $\Delta R_z/R_a$ values that meet the values recited in claim 1 have advantageous properties. *See, e.g.*, Ex. 1005 ¶ 45 (Kim '761, disclosing that preferably the “difference in peak count roughness R_{pc} between the shiny surface . . . and the matte surface . . . of the electrolytic copper foil . . . is preferably 60 or less” because “when the difference in the peak count roughness R_{pc} exceeds 60 capacity maintenance of the secondary battery is deteriorated.”);¹⁵ Ex. 1007, 3:16–23, 4:14–23 (Cheng, disclosing that the foils of Cheng’s invention have (220) and (311) surfaces that provide increased elongation and that solve a high roughness problem that rendered traditional products unsuitable for use in a lithium ion secondary battery), 10:27–34 (Cheng, disclosing that in the foils of Cheng’s invention “the roughness difference between both sides was extremely small” and thus “it was . . . not easy for the electrolytic copper foil to break or fracture during the charging-discharging cycles and the life of a battery is thus increased”), Tables 3 & 4 (Cheng, disclosing embodiments and comparative examples with TC(220) values meeting the requirements of claim 1); Ex. 1008, 6:36–44 (Wolski, disclosing that “the surface roughness R_z at the matte side of the untreated copper foil of the present invention is the same or smaller than the surface roughness R_z at the shiny side . . . so that the surface treated copper foil . . . becomes more low-profiled . . . whereby it becomes a foil having a large etching factor”), 9:1–29 & Table 2 (Wolski, disclosing

¹⁵ Dr. Randall testifies that “Kim '761’s peak count roughness R_{pc} corresponds to the peak density PD of the '706 patent.” Ex. 1003 ¶ 52. At this stage in the proceeding, this testimony is un rebutted.

embodiments meeting the $\Delta R_z/R_a$ of claim 1, describing them as having “matte side roughnesses” that are “sufficiently small,” and as having “excellent” “high temperature elongation characteristics”), 11:37–41 (Wolski, describing comparative examples as having “large” matte side roughnesses “whereby etching factors are not good”), 12:12–27 (Wolski, teaching that “as compared with a conventional untreated copper foil, both surfaces of the untreated copper foil obtained by [Wolski’s] invention are flat” resulting in a low profile foil that has “excellent elongations at room temperature and high temperature and also high tensile strength”). The teachings in the prior art support the presently unrebutted testimony of Dr. Randall explaining why the POSA would have been motivated to modify Kim ’761’s copper foil to have the claimed TC(220) and $\Delta R_z/R_a$. Ex. 1003 ¶¶ 66–68, 71–74; *Pfizer Inc., v. Sanofi Pasteur Inc.*, 94 F.4th 1341, 1348 (Fed. Cir. 2024) (“Where [a gap in prior art] includes a parameter not necessarily disclosed in the prior art, it is not improper to consider whether or not it would have been recognized as result-effective. If so, then the optimization of that parameter is ‘normally obvious.’”). Accordingly, we are not persuaded by Patent Owner’s argument that Petitioner failed to articulate a sufficient motivation to combine the references. To the contrary, the preliminary record presents a strong showing that the POSA would have been motivated to combine the references in the manner described in the Petition.

Patent Owner asserts that Petitioner’s arguments rest on the assumption that “different surface parameters selected from each reference in the three-reference combinations are all interchangeable,” but that

Petitioner provides “inadequate support for this assumption.” Prelim. Resp. 22. According to Patent Owner, Petitioner provides no explanation “why the surface characteristics from one reference would be compatible with the surface characteristics from another reference.” *Id.* at 23. Patent Owner derives, from the cited art and from Dr. Randall’s testimony, a list of parameters and conditions that affect the surface properties of copper foils and argues that “Dr. Randall does not explain how a POSA would have adjusted any of these conditions to arrive at a foil with the claimed surface characteristics.” *Id.* at 25–26. It is not enough, Patent Owner argues, that each reference discloses electroplating copper foils. *Id.* at 22, 24. Nor, Patent Owner contends, can Petitioner rely on the teaching of the challenged patent that the three claimed ranges can be achieved by optimizing three independent process parameters separately. *Id.* at 24. Absent the teachings of the challenged patent, Patent Owner asserts that “the Petition is left with nothing but conclusory assertions of a reasonable expectation of success by its expert.” *Id.* at 25. Patent Owner’s arguments do not persuade us that Petitioner’s showing of a reasonable expectation of success is insufficient to support institution.

Petitioner does not rely merely on the fact that all three references disclose electroplating copper foils. Rather, Petitioner relies on the presently un rebutted testimony of Dr. Randall that the processes Kim ’761, Cheng, and Wolski used to make their foils were similar and compatible with one another. For example, Dr. Randall testifies that “the electrodeposition temperatures, current densities, and primary solution components (copper ions, sulfuric acid) and proportions are the same or similar between Kim

'[76]1, Cheng, and Wolski.” Ex. 1003 ¶ 75; *see also, id.* ¶ 70 (explaining that Cheng and Kim “describe deposition at similar temperatures, using similar plating currents, in solutions composed primarily of similar amounts of copper ions and sulfuric acid”). On this preliminary record, the similarity of the processes in Kim '761, Cheng, and Wolski helps support that the POSA would reasonably expect success in making a foil having the TC(220) of Chen and the $\Delta R_z/R_a$ of Wolski while retaining the ΔPD properties of Kim '761's foil. This is particularly true when viewed with Dr. Randall's testimony describing the process modifications the POSA would have tried in view of Cheng and Wolski to obtain the claimed TC(220) and $\Delta R_z/R_a$ as “slight.” *Id.* ¶ 70 (“It would have been obvious to try slightly modifying Kim '761's solution by, for example, including the polyvinyl alcohol and/or small molecular weight glue incorporated into Cheng's solution, to obtain Cheng's TC(220) values.”), ¶ 75 (“It would have been obvious to try slightly modifying Kim '761's solution by, for example, . . . including the MPS, the low molecular weight glue, and chlorine ions in the proportions disclosed by Wolski, to obtain Wolski's R_z and R_a values.”).

Petitioner's position that the POSA would reasonably have expected success is further supported by presently-unrebutted testimony suggesting that TC(220) and $\Delta R_z/R_a$ are “robust to various process conditions.” Ex. 1003 ¶¶ 80 (Dr. Randall's testimony that the fact that all six of Cheng's embodiments and five out of the six comparative examples had TC(200) values within the claimed range “suggests that the manufacture of copper foils having the claimed TC(220) is robust to various process conditions, as opposed to being highly sensitive to particular additives or additive

concentrations”), 81 (Dr. Randall’s testimony that the fact that Wolski’s four examples and two comparative examples fall within the claimed $\Delta R_z/R_a$ range “suggests that the claimed $|\Delta(R_z/R_a)|$ can be achieved robustly, as opposed to being highly sensitive to electrolytic solution composition”).

Dr. Randall concedes that PD, TC(220), and R_z/R_a “may not be independent from one another, or tunable independently.” Ex. 1003 ¶ 77. For example, Dr. Randall candidly acknowledges that “a change intended to modify TC(220) might have a secondary effect of changing R_z and/or R_a .” *Id.* However, Dr. Randall goes on to explain that “this interdependency does **not** mean that simultaneous optimization of these variables . . . would have been beyond the skill of a [POSA], and in my experience, it would have been common.” *Id.* ¶ 78. Patent Owner faults Dr. Randall for citing the teaching of the ’706 patent as support for his statement that it would have been common to simultaneously optimize the three claimed parameters. Prelim. Resp. 24–25. But we view this testimony as permissibly rebutting the potential argument that the POSA would have been unable to simultaneously optimize three parameters rather than impermissibly providing reason to expect success in doing so.

At this stage in the proceeding, Dr. Randall’s presently-unrebutted testimony supports that: 1) the processes described for making copper foils in Kim ’761, Cheng, and Wolski are similar, 2) the modifications the POSA would have tried in view of Cheng and Wolski to obtain the claimed TC(220) and $\Delta R_z/R_a$ are “slight,” and 3) TC(220) and $\Delta R_z/R_a$ are “robust to various process conditions.” *Id.* ¶¶ 70, 75, 80–81. In view of this evidence, the preliminary record provides a strong showing that the POSA

would reasonably have expected success in simultaneously optimizing the three claimed parameters. *Id.* ¶¶ 69, 75, 78.

Patent Owner argues that “Dr. Randall does not explain how a POSA would have adjusted any of these conditions to arrive at a foil with the claimed surface characteristics TC, $|\Delta(Rz/Ra)|$, and $|\Delta PD|$.” Prelim. Resp. 26. This argument is not convincing because the evidence currently of record supports that optimization requires only ordinary skill. *See e.g.*, Ex. 1003 ¶¶ 69 (Dr. Randall’s testimony identifying process parameters disclosed in Cheng and testifying that “[t]hese process parameters could easily be selected and modified by an experimentalist based on Cheng’s disclosure, for example, by adding the disclosed components to the solution.”), 75 (Dr. Randall’s testimony that trying to obtain Wolski’s Rz and Ra values would involve “slightly modifying Kim ’761’s solution”), 78 (Dr. Randall’s testimony that optimizing interdependent variables would not have been beyond the skill of the POSA and would, in his experience, have been common).

Patent Owner’s argument that Petitioner does not provide details on how the POSA would have adjusted process parameters to arrive at the claimed TC, $\Delta(Rz/Ra)$, and ΔPD requires more detail than we understand the law to require. *See In re Applied Materials, Inc.*, 692 F.3d 1289, 1297–98 (Fed. Cir. 2012) (affirming decision finding obviousness based on optimization of result effective variable where “nothing indicate[d] that the optimization of the variable was anything other than the exercise of ordinary skill in the art”). Moreover, Petitioner does provide some detail as to modifications the POSA would try in order to arrive at the claimed

properties. *See e.g.*, Ex. 1003 ¶¶ 70, 75 (identifying specific modifications that the POSA would try in view of Cheng and in view of Wolski to arrive at the claimed TC(220) and $\Delta R_z/R_a$ values).

In sum, the Petition supports that Kim '761 discloses the ΔPD of claim 1, Cheng discloses the TC(220) of claim 1, and Wolski discloses the $\Delta R_z/R_a$ of claim 1. In addition, the current record supports that the POSA would have been motivated to modify the copper foils of Kim '761 to have the TC(220) and $\Delta R_z/R_a$ of claim 1 and that the POSA would have had a reasonable expectation of success in doing so. At present, Patent Owner's arguments to the contrary do not persuade us otherwise. In sum, Petitioner demonstrates a particularly strong showing that it is likely to succeed in establishing that claim 1 would have been obvious over Kim '761, Cheng, and Wolski.

2. Claims 2–5

Petitioner contends that claims 2–5 are taught or suggested in the combination of Kim '761, Cheng, and Wolski, and that the POSA would have been motivated to modify the prior art to arrive at the claimed subject matter with a reasonable expectation of success. Pet. 25–32. Petitioner's contentions are supported by citation to the prior art and expert testimony. *Id.* Patent Owner does not differentiate its arguments by claim, relying on the same arguments for all of the claims. Prelim. Resp. 17–27. On this preliminary record, and for the reasons discussed above, Petitioner demonstrates a particularly strong likelihood that it will succeed in establishing that claims 2–5 would have been obvious over Kim '761, Cheng, and Wolski.

F. Obviousness over Kim '761, Cheng, Wolski in combination with Kim '571, Lee, and/or Shinozaki '681 (Grounds 1B–1E)

Grounds 1B–1E rely on the combination of Kim '761, Cheng, and Wolski discussed above and add various combinations of Kim '541, Lee, Shinozaki '681, and/or Dibashi to address requirements added by dependent claims 6–10. For each of these grounds, Petitioner sets forth an element-by-element comparison of the challenged claims to the asserted art. Pet. 32–56. In its Preliminary Response, Patent Owner relies on its arguments for Ground 1A and claim 1 to address Petitioner's arguments relating to Grounds 1B–1E and the dependent claims challenged therein. Prelim. Resp. 17–27. We addressed Patent Owner's arguments in Section III.E. For the reasons discussed in Section III.E, Petitioner has shown a likelihood that it will prevail on its assertion that at least one of the challenged claims is unpatentable based on the grounds advanced here, and we therefore institute *inter partes* review as to the remaining obviousness grounds. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018) (“Section 314(a) does not require the Director to evaluate every claim individually. Instead, it simply requires him to decide whether the petitioner is likely to succeed on “at least 1” claim. Once that single claim threshold is satisfied, it doesn't matter whether the petitioner is likely to prevail on any additional claims; the Director need not even consider any other claim before instituting review.”).

G. Obviousness over Dobashi, Shinozaki '922, Chou, Kim '541, Lee, and Shinozaki '681 (Grounds 2A–2D)

Each of Grounds 2A–2D relies on the combination of Dobashi, Shinozaki '922, and Chou as disclosing the Δ PD, TC(220), and Δ Rz/Ra recited in claim 1. Petitioner contends that it would have been obvious to

modify the copper foil disclosed in Dobashi (which Petitioner relies upon as disclosing the recited ΔPD) to include the TC220 of Chou and the $\Delta Rz/Ra$ of Shinozaki '922. Pet. 57. The rationales proffered in the Petition for combining Dobashi, Shinozaki '922, and Chou and for expecting success in doing so are substantially the same as for Grounds 1A–1E, with the exception that Petitioner relies on different teachings to show that TC(220), and $\Delta Rz/Ra$ are result effective variables. Pet. 57 (addressing the combination of Dobashi, Shinozaki '922, and Chou and explaining that “[t]he reasoning here is substantially similar to that provided in Section IV.D,” which addressed Ground 1A), 58 (addressing optimization of $\Delta Rz/Ra$ explaining “for the reasons discussed in Section IV.D . . . it would have been obvious for a [POSA] to optimize Rz and Ra to have the values in Table 2 of Shinozaki '922”), 59 (addressing optimization of TC(220) explaining “it would have been obvious for a [POSA] to optimize TC(220) to have a value taught by Chou . . . with a reasonable expectation of success for reasons described by Dr. Randall and similar to those provided in Section IV.D”).

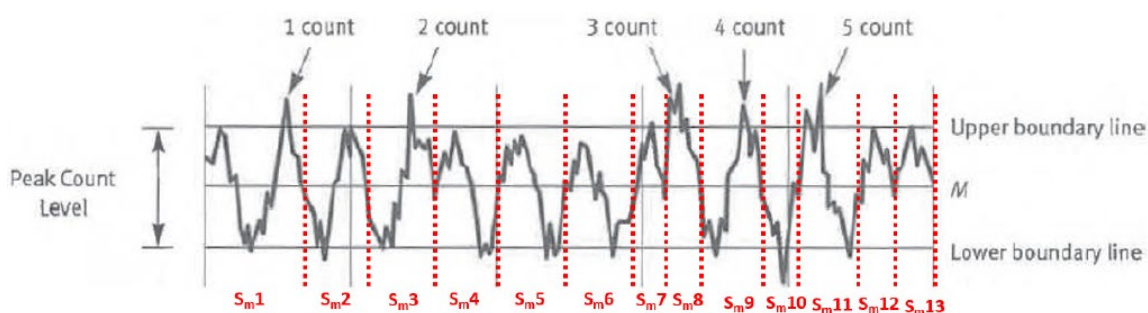
In its Preliminary Response, Patent Owner presents much the same arguments as to why the POSA would not have been motivated to combine references with an expectation of success as it relied upon for Grounds 1A–1E. *See* Prelim. Resp. 19–27 (arguing absence of motivation to combine and absence of reasonable expectation for all grounds together).

Given the similarity in Petitioner’s rationale for combining references in Grounds 1A–1E and in Grounds 2A–D, and the similarity in Patent Owner’s arguments against that rationale, we will not separately analyze

motivation to combine and reasonable expectation of success for Ground 2A–2D. Instead, we direct the parties to our analysis in Section III.E *supra* for our views on motivation and expectation of success. We focus our analysis of Grounds 2A–2D on the parties’ dispute as to whether Dobashi discloses the claimed Δ PD.

Each of Grounds 2A–2D relies on Dobashi as disclosing the Δ PD recited in claim 1. Dobashi does not expressly disclose Δ PD, but Petitioner contends that the claimed Δ PD can be derived from Dobashi’s disclosure of RSm, a surface roughness measurement. Petitioner contends that “RSm is essentially a measure of the average spacing between peaks.” Pet. 59 (citing Ex. 1003 ¶ 184). As discussed in Section I.D.3 *supra*, PD measures the number of SAE peaks per unit length, where SAE peaks are defined as profile irregularities that consecutively intersect a lower and an upper boundary line set by a designer or an instrument operator. Petitioner contends that “RSm and PD contain the same information but express it inversely from one another.” *Id.* According to Petitioner, this allows one to calculate PD from RSm. Dr. Randall explains by example: “if RSm is 0.5 mm (indicating a 0.5 mm spacing between peaks), then, over a 4 mm sampling length, we would measure $4/(0.5) = 8$ peaks, or $PD = 8$ ea.” Ex. 1003 ¶ 185.

Patent Owner contends that PD and RSm are not in a simple inverse relationship because PD counts peaks that cross preset upper and lower boundary lines (SAE peaks) while RSm counts peaks that are 10% of the sum of the maximum peak height and the maximum valley depth. Prelim. Resp. 28–29 (arguing that PD and RSm measure different peaks); Ex. 1003 ¶¶ 186–187 (Dr. Randall testimony explaining how RSm peaks are counted). Patent Owner illustrates the difference between PD and RSm using an annotated version of Figure 1-14 from Exhibit 1017 (reproduced below).



Annotated Figure 1-14 includes three horizontal lines: a mean line, an upper boundary line, and a lower boundary line. *Id.* It depicts peak height relative to these three lines, labeling SAE peaks where the peak height crosses the upper boundary line and the lower boundary line in succession. *Id.* at 9. Thus, Figure 1-14 includes five SAE peaks, labeled “1-count,” “2-count,” “3-count,” “4-count,” and “5-count.” *Id.* Patent Owner annotates the figure with thirteen vertical dashed red lines showing spacing lengths between profile irregularities—i.e., between peaks that would be counted in RSm. *Id.*

On this preliminary record, Patent Owner’s argument that Dr. Randall’s RSm-derived measurement of PD is inaccurate appears to have merit. Patent Owner’s annotated Figure 1-14 illustrates the potential for inaccuracy in Dr. Randall’s calculation. In Figure 1-14, there are thirteen

RSm profile irregularities that would be counted as peaks in Dr. Randall's RSm-derived calculation of PD, but only five peaks that actually meet the definition of an SAE peak. Thus, in the example of Figure 1-14, Dr. Randall's calculation would appear to overstate PD.

Patent Owner identifies as a further problem that Petitioner did not apply $\pm 0.5 \mu\text{m}$ as the threshold for identifying peaks. According to Patent Owner, the '706 patent sets the upper and lower boundary lines for purposes of identifying SAE peaks at $\pm 0.5 \mu\text{m}$. Prelim. Resp. 29 (citing Ex. 1001, 8:36–43). Patent Owner argues that this is a problem for Petitioner because Dobashi does not have any peaks with a height of at least $0.5 \mu\text{m}$ above the mean line. *Id.* at 33. Patent Owner asserts that absent such peaks, the “peak density in Dobashi's Examples would likely be zero, far from the two-digit values calculated by Petitioner.” *Id.* at 35. According to Patent Owner, “[w]ithout establishing that Dobashi's surfaces having the cited RSm values would have peaks with a height of at least $0.5 \mu\text{m}$ above the mean line, Petitioner cannot rely on Dobashi as inherently disclosing the missing peak density limitation.” *Id.* at 37.

Dr. Randall appears to acknowledge that using the $\pm 0.5 \mu\text{m}$ measurement criteria specified in the '706 patent would change his PD calculation, explaining that using such the '706 patent's $\pm 0.5 \mu\text{m}$ “would lead to a **higher RSm and lower PD**, because some peaks ‘counted’ using the smaller discrimination criteria would not be counted using the $0.5 \mu\text{m}$ criteria.” Ex. 1003 ¶¶ 186–188. Therefore, Dr. Randall concludes that applying the '706 Patent's height discrimination criteria would result in a lower value than the value he calculated relying on 10% of the sum of the

maximum peak height and the maximum valley depth as the height discrimination criteria. *Id.* ¶ 189.

Patent Owner’s argument raises two questions that are best resolved on a more fully developed record. First, the ’706 patent states:

The peak density PD was measured according to ASME Bb 46.1 standards, and the peak density was measured using a roughness tester from Mahr Company (Model name: Marsurf M300) and a stylus tip having a radius of 2 μm . ***The peak count level was $\pm 0.5 \mu\text{m}$ from the center line of the profile***, the measurement length, excluding the cut-off length, was 4 mm, and the cut-off length was 0.8 mm at the first stage and the last stage. The measurement pressure was 0.7 mN. The average of the values obtained by performing the measurement three times was taken as the peak density.

Ex. 1001, 8:36–46 (emphasis added). If Patent Owner maintains its argument that using 0.5 μm as height discrimination criteria prevents Dobashi from meeting the ΔPD claim requirement of claim 1, it should address whether the above passage—including particularly the emphasized language—is definitional such that the claimed ΔPD must be determined using 0.5 μm as height discrimination criteria.

Second, Patent Owner asserts that absent peaks greater than 0.5 μm , the “peak density in Dobashi’s Examples [which disclose matte side RSm] would likely be zero.” Prelim. Resp. 35. If Patent Owner maintains its argument that using 0.5 μm as height discrimination criteria prevents Dobashi from meeting the ΔPD claim requirement of claim 1, it should address whether disclosure of a matte side PD of zero would prevent Dobashi’s examples from meeting the requirement of claim 1 for a ΔPD that “is 96 ea or less,” particularly in view of Petitioner’s argument that “it would

have been obvious to make the shiny side PD lower than or similar to the matte side PD.” Pet. 63.

Because Petitioner demonstrates a reasonable likelihood of success in proving that at least one claim of the ’706 patent is unpatentable, we institute on all grounds and all claims raised in the Petition. *See* 37 C.F.R. § 42.108(a). Therefore, at this stage of the proceeding, it is not necessary for us to further assess the challenges presented in Ground 2A–2D. Those challenges, in our view, are best left for trial after full development of the record.

IV. CONCLUSION

On this preliminary record, Petitioner has established a reasonable likelihood of prevailing in showing that at least one of the challenged claims is unpatentable based on the grounds advanced in the Petition.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *granted*, and we institute *inter partes* review of claims 1–10 of the ’706 patent based on the grounds asserted in this Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given of the institution of trial, which will commence on the entry date of this Decision.

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