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.

IPR2024-01460
Patent 10,480,090 B2

Before JOHN G. NEW, JO-ANNE M. KOKOSKI, and
JON B. TORNQUIST, *Administrative Patent Judges.*

TORNQUIST, *Administrative Patent Judge*.

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

I. INTRODUCTION

Solus Advanced Materials Co., Ltd. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting *inter partes* review of claims 1–11 of U.S. Patent No. 10,480,090 B2 (Ex. 1001, "the '090 patent"). SK nexilis Co., Ltd. ("Patent Owner") filed a Preliminary Response (Paper 8, "Prelim. Resp."). With our authorization, Petitioner filed a Reply (Paper 9, "Prelim. Reply") and Patent Owner filed a Sur-reply (Paper 10, "Prelim. Sur-reply") addressing discretionary denial. We also authorized one-page briefs from each party addressing the recent Director Review decision in *Motorola Solutions, Inc. v. Stellar, LLC*, IPR2024-01205, Paper 19 (PTAB March 28, 2025) ("Motorola"). Paper 12 ("Supplemental Brief" or "Sup. Brief"); Paper 13 ("Petitioner's Response Brief").

Under 37 C.F.R. § 42.4(a), the Board has authority to determine whether to institute an *inter partes* review. Applying the standard set forth in 35 U.S.C. § 314(a), we may not institute an *inter partes* review unless the information presented in 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." Institution of *inter partes* review, however, is discretionary. *See Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."). For the reasons stated below, we exercise our discretion not to institute an *inter partes* review.

A. Real Parties-in-Interest

Petitioner identifies itself and 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. 79–80.

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

B. Related Proceedings

The parties identify *SK nexilis Co., Ltd. v. Solus Advanced Materials Co., Ltd,* 2-23-cv-00539 (EDTX), filed November 21, 2023, as a related matter ("district court proceeding"). Pet. 80; Paper 4, 2. Patent Owner also identifies co-pending *inter partes* reviews IPR2024-01461, IPR2024-01462, IPR2024-01463, and IPR2025-00005 as related matters. Paper 4, 2.

II. BACKGROUND

A. The '090 Patent

The '090 patent is directed to, among other things, "an electrolytic copper foil which is capable of securing a secondary battery with high capacity maintenance." Ex. 1001, 1:62–64. Figure 1 of the '090 patent is reproduced below:

FIG. 1

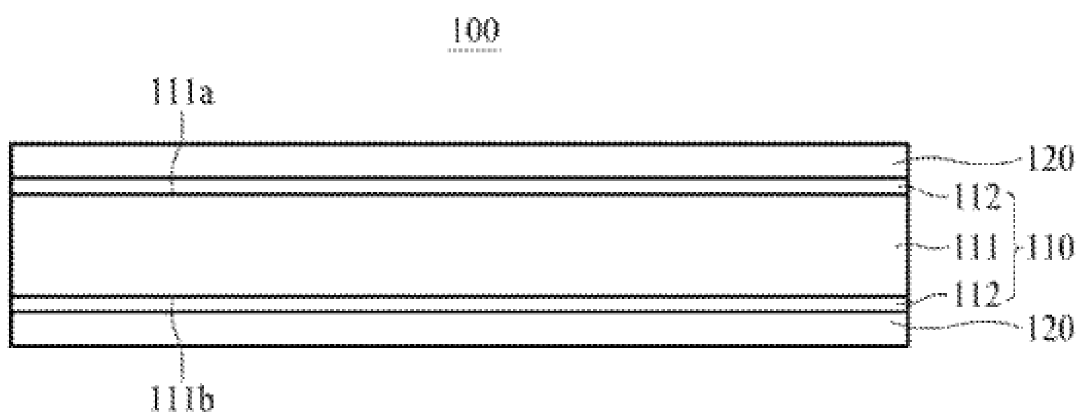

Figure 1 is a section view of an electrode for a secondary battery according to one embodiment of the '090 patent. Ex. 1001, 3:32–34. As shown in Figure 1, electrode 100 includes current collector 110 and active material layer 120, which may be formed on both the upper and lower surfaces of current collector 110. *Id.* at 3:62–67. Current collector 110 includes electrolytic copper foil 111 having a thickness of 3 to 20 μm and a tensile strength of 30 to 60 Kgf/mm^2. Ex. 1001, 4:11–14. Current collector 110 may also include protective layer 112, which is formed on both the upper and lower surfaces of electrolytic copper foil 111. *Id.* at 4:14–19.

The '090 patent explains that "electrolytic copper foil 111 of the present invention may be formed on a rotational anode drum by electroplating," resulting in a foil with "a first surface (also called a 'shiny surface') 111a which contacts the rotational anode drum in the process of electroplating and a second surface (also called a 'matte surface') 111b opposite to the first surface." Ex. 1001, 4:22–27. The '090 patent further explains that both surfaces of electrolytic copper foil 111 have a ten-point mean roughness R_{ZJIS} of 2 μm or less. *Id.* at 4:61–64. According to the '090 patent, when either surface has a ten-point mean roughness exceeding 2 μm, contact uniformity between current collector 110 and active material layer 120 does not reach a desired level and "the secondary battery thus cannot satisfy a capacity maintenance of 90% or higher required in the art." *Id.* at 4:64–5:3. The '090 patent notes, however, that having a ten-point mean roughness of 2 μm or less is not sufficient to ensure a capacity maintenance of the secondary battery of 90% or higher. *Id.* at 5:4–13. Rather, "[a]s a result of repeated research," the inventors determined that a peak count roughness R_{pc} of the electrolytic copper foil 111 is an important factor in stably securing capacity maintenance of 90% or higher. *Id.* at 5:19–22.

Figure 2 of the ’090 patent is reproduced below:

FIG. 2

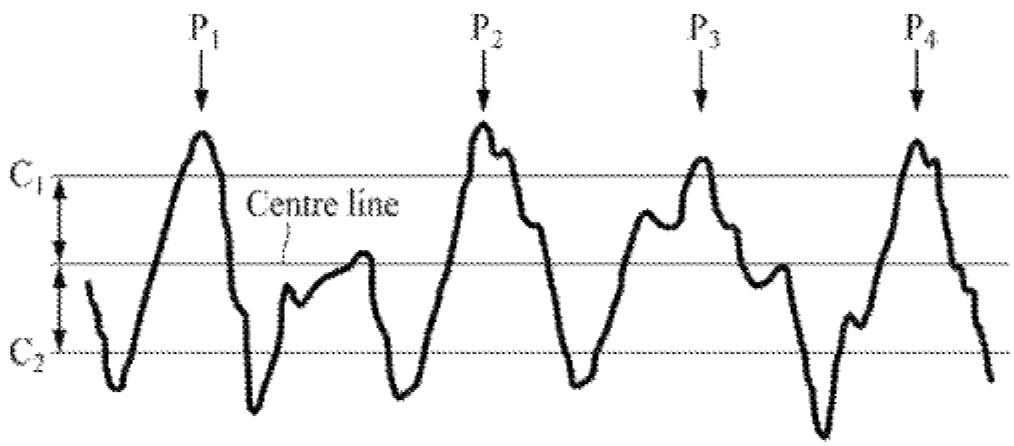

Figure 2 “illustrates a surface roughness profile obtained according to steel-iron test schedule (SEP 1940) specification.” Ex. 1001, 3:35–37. As used in the ’090 patent and depicted in Figure 2, peak count roughness R_{pc}

> means an average of peak count roughness R_{pc} values obtained at three randomly-selected points, and the peak count roughness R_{pc} of each point is the number of effective peaks P_1, P_2, P_3, and 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). In this case, there is at least one valley deeper than a lower criteria line C2 of −0.5 μm between adjacent ones of the effective peaks. If 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, all of 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. at 5:26–42.

The ’090 patent explains that when the peak count roughness R_{pc} is less than 10, capacity maintenance of the secondary battery is deteriorated due to the stress caused during the charge/discharge of the secondary battery being concentrated on mountains which locally protrude. Ex. 1001, 5:46–50. Likewise, when the peak count roughness R_{pc} exceeds 100, capacity maintenance is deteriorated “because the active material cannot be uniformly coated on the electrolytic copper foil 111 due to the excessive number of mountains.” *Id.* at 5:51–55.

The ’090 patent explains that the difference in peak count roughness R_{pc} between the shiny surface and matte surface of electrolytic copper foil 111 is preferably 60 or less. Ex. 1001, 5:56–58. This is because, when the difference in peak count roughness exceeds 60, “capacity maintenance of the secondary battery is deteriorated due to [the] difference in surface appearance between both surfaces 111a and 111b.” *Id.* at 5:61–64.

B. Illustrative Claim

Independent claim 1 is the only independent claim in the ’090 patent and is reproduced below.

> 1. [1pre] An electrolytic copper foil for a secondary battery, the electrolytic copper foil comprising:
>
> [1a] a first surface; and
>
> [1b] a second surface opposite to the first surface,
>
> [1c] wherein each of the first and second surfaces has a peak count roughness Rpc of 10 to 100,
>
> [1d] wherein the peak count roughness Rpc of each of the first and second surfaces is an average of peak count roughness Rpc values measured at randomly-selected three points,
>
> [1e] the peak count roughness Rpc of each point is the number of effective peaks which rise above an upper criteria line of 0.5 μm per

> unit sampling length of 4 mm in a surface roughness profile obtained according to steel-iron test schedule (SEP 1940), and there is at least one valley deeper than a lower criteria line of −0.5 μm between adjacent ones of the effective peaks.

Ex. 1001, 10:9–27; Pet. at *v* (Petitioner's Claim Listing providing the claim element numbering scheme used in the Petition).

C. Asserted Grounds of Unpatentability

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)/Basis
1–4, 7, 8, 10	103	Shinozaki[2]
5, 6, 9, 11	103	Shinozaki, Toshio[3], Kim[4]
1–4, 7, 8, 10	103	Sano[5], Griesi[6]
5, 6, 9, 11	103	Sano, Griesi, Toshio, Kim
1–11	103	Dobashi[7]

In support of the Petition, Petitioner provides a declaration from Dr. Michael Randall. Ex. 1003.

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[1] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the '090 patent has an effective filing date after that date, we refer to the AIA version of § 103. Ex. 1001, code (60).

[2] US 2013/0108922 A1, published May 2, 2013. Ex. 1004 ("Shinozaki").

[3] KR 10-2011-7027236, published November 11, 2010. Ex. 1013 (Korean Language); Ex. 1014 (certified translation, "Toshio").

[4] US 2013/0108887 A1, published May 2, 2013. Ex. 1012 ("Kim").

[5] US 2006/0191798 A1, published August 31, 2006. Ex. 1008 ("Sano").

[6] M. Griesi, *Characterization of Electrodeposited Copper Foil Surface Roughness for Accurate Conductor Power Loss Modeling* (Master's thesis). Ex. 1015 ("Griesi").

[7] US 2009/0047539 A1, published February 19, 2009. Ex. 1007 ("Dobashi").

III. ANALYSIS

A. Legal Standard

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and "the prior art are such 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 said 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) when in evidence, objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

In order to determine whether an invention would have been obvious at the time the application was filed, we consider the level of ordinary skill in the pertinent art. *Graham*, 383 U.S. at 17. In assessing the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quotation omitted).

Petitioner contends that one of ordinary skill in the art "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." Pet. 3–4. Petitioner further contends that "[a]dditional education, such as a graduate degree, could compensate for less work experience, and additional work experience could compensate for less formal education." *Id.* at 4 (citing Ex. 1003 ¶ 10).

Patent Owner applies Petitioner's recited level of ordinary skill in the art for purposes of its Preliminary Response. Prelim. Resp. 4.

Upon review of the parties' arguments and the prior art of record, we adopt Petitioner's unopposed definition of the ordinarily skilled artisan for purposes of this decision as it appears consistent with the disclosures of the '090 patent and the prior art of record.

C. Claim Construction

In an *inter partes* review proceeding, a patent claim is construed 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) (as amended Oct. 11, 2018). This rule adopts the same claim construction standard used by Article III federal courts, which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. Under this standard, the words of a claim are generally given their "ordinary and customary meaning," which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Neither party contends that any claim terms of the '090 patent require construction. Pet. 4; Prelim. Resp. 4. Upon review of the record and the parties' arguments, we agree that no claim terms of the '090 patent require express construction. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (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 Relevant Surface Measurements

The '090 patent and the prior art of record disclose various surface measurements, including Rz (R_{ZJIS}), Ra, Rpc, and Rsm (or Sm). The Rpc method of the patent is discussed above. We provide an overview of the Rz (R_{ZJIS}), Ra, and Rsm (or Sm) measurement methods below.

1. Rz or R_{ZJIS}

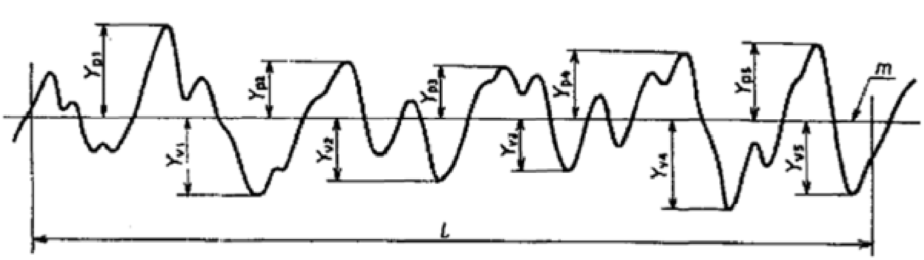
Rz, or R_{ZJIS}, is a 10-point mean roughness and "represents the sum of the absolute values of the five highest peaks and the absolute values of the five lowest valleys of a surface (e.g., copper foil surface) over a reference length (*l*), divided by 5." Ex. 1003 ¶ 21; Ex. 1017, 13; Ex. 1018, 24–25; Ex. 1001, 4:32–33. The measurement and calculation method for Rz is reproduced below:

$$R_z = \frac{|Y_{p1} + Y_{p2} + Y_{p3} + Y_{p4} + Y_{p5}| + |Y_{v1} + Y_{v2} + Y_{v3} + Y_{v4} + Y_{v5}|}{5}$$

where, Y_{p1}, Y_{p2}, Y_{p3}, Y_{p4}, Y_{p5} : altitudes of the heights of five highest profile peaks of the sampled portion corresponding to the reference length l

Y_{v1}, Y_{v2}, Y_{v3}, Y_{v4}, Y_{v5} : altitudes of the depths of five deepest profile valleys of the sampled portion corresponding to the reference length l

Fig. 4. Determination of R_z



As shown in the figure above, in determining the Rz value for a reference length l, the absolute value of the five highest peaks Y_{p1}–Y_{p5} and the absolute value for the five lowest valleys Y_{v1}–Y_{v5} are added together and then the sum is divided by 5. Ex. 1017, 13, Fig. 4. According to at least one standard, when the Rz value is between 0.5 and 10.0 µm, the standard reference length used is 0.8 mm and the evaluation length is 4 mm. Ex. 1017, Table 5; Ex. 1003 ¶ 15.

2. Ra

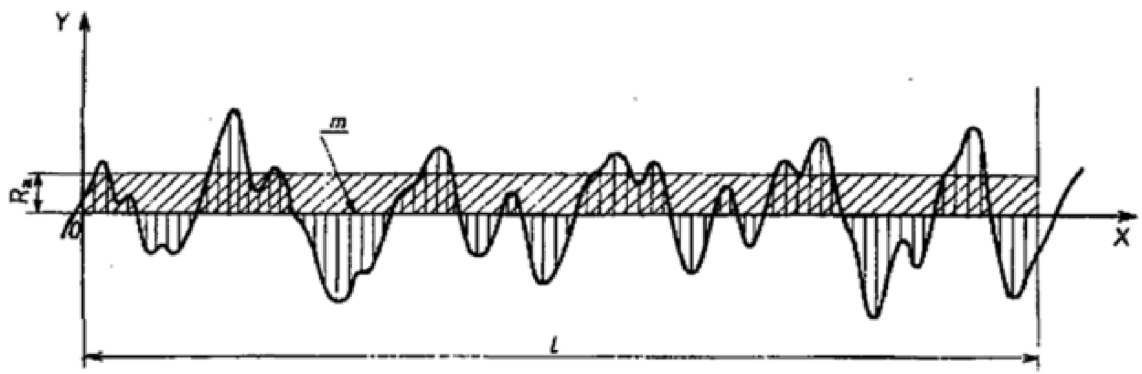
Ra represents the average roughness of a surface, calculated as the mean absolute deviation of the surface profile from the central mean line over a specified sampling length. Ex. 1003 ¶ 16 (citing Ex. 1016, 1–2; Ex. 1017, 7). According to Dr. Randall, “mathematically, Ra is calculated by integrating the absolute value of the height of the assessed profile ‘f(x)’ over a reference length (*l*) and dividing by the reference length.” Ex. 1003

¶ 16 (citing Ex. 1017, 7, Fig. 2). The method of calculating Ra is depicted in Figure 2 of Exhibit 1017,[8] below.

$$R_a = \frac{1}{l}\int_0^l |f(x)|dx$$

where, l : reference length

Fig. 2. Determination of R_a



Ex. 1017, Fig. 2. Figure 2 above depicts the integration of the absolute value of the height of profile "f(x)" over reference length *l*. *Id.*

3. Rsm

Rsm represents the "mean value of the profile element widths Xs," as shown in the figure below.

[8] Japanese Industrial Standard, *Surface roughness – Definitions and designation,* JIS B 0601. Ex. 1017.

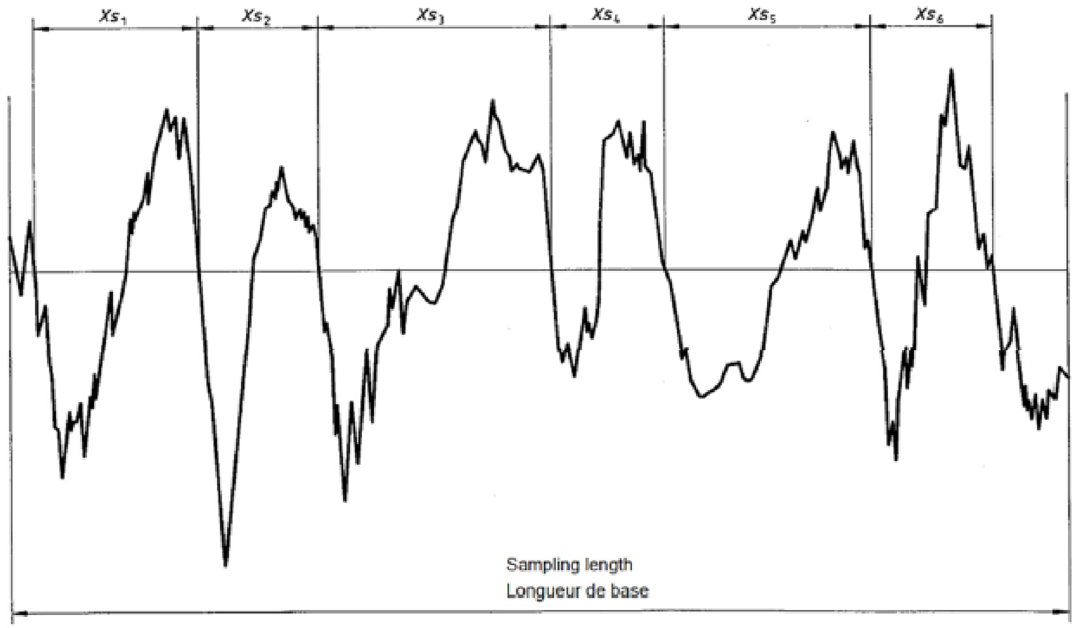


Figure 10 — Width of profile elements
Figure 10 — Largeur des éléments du profil

Ex. 1019, 18–19, Fig. 10. As depicted above, Dr. Randall testifies that Rsm represents the average distance between pairs of consecutive peaks and valleys. Ex. 1003 ¶¶ 34–35.

IV. ANALYSIS

A. Discretionary Denial Under 35 U.S.C. § 314(a)

Patent Owner contends we should discretionarily deny the Petition under 35 U.S.C. § 314(a) in view of the parallel district court proceeding. Prelim. Resp. 9. Petitioner disagrees. Prelim. Reply 1–5.

The Board's precedential order in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 5–16 (PTAB Mar. 20, 2020) (precedential) ("*Fintiv*") identifies several factors used when considering whether to deny institution in view of related litigation. These factors, which "relate to whether efficiency, fairness and the merits support the exercise of authority to deny institution," are:

1. Whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;

2. The proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;

3. The investment in the parallel proceeding by the court and the parties;

4. The 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.

Fintiv, Paper 11 at 5–6.[9]

1. Factor 1

Fintiv factor 1 asks whether the court has granted a stay or evidence exists that one may be granted if a proceeding is instituted. *Fintiv*, Paper 11 at 6–7.

Patent Owner contends that factor 1 is neutral because, although an opposed motion to stay has been filed in the parallel litigation, it is still pending. Prelim. Resp. 10.

Petitioner asserts that *Fintiv* factor 1 is "at best neutral as the motion to stay remains pending." Prelim. Reply 1.

[9] The "Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation," issued on June 21, 2022, was rescinded by the United States Patent and Trademark Office on February 28, 2025. On March 24, 2025, the Office issued "Guidance on USPTO's recission of 'Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation.'" *Available at* https://www.uspto.gov/sites/default/files/documents/guidance_memo_on_interim_procedure_recission_20250324.pdf.

As no stay has been granted by the district court, and the court has not indicated whether one might be entered, we find that *Fintiv* factor 1 is neutral.

2. Factor 2

Fintiv factor 2 looks to the proximity of the court's trial date to the Board's projected statutory deadline to issue a final written decision. *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.*

Patent Owner asserts trial in the district court proceeding is scheduled to begin November 3, 2025, which is nearly six months before the April 23, 2026, statutory deadline for a final written decision in this proceeding. Prelim. Resp. 10. Patent Owner further contends that the median time-to-trial in the Eastern District of Texas is 21.9 months, which would place the trial even earlier than its currently scheduled date. *Id.* at 11 (citing Ex. 2006, 35; Ex. 2007).

Petitioner argues that the Eastern District of Texas's growing backlog of cases has caused the median time-to-trial to increase from 21.9 to 23.0 months, and asserts that its *Sotera*[10] stipulation (discussed below) means there will be "minimal" potential for conflict between the district court proceeding and the instant proceeding. Prelim. Reply 1 (citing Ex. 1042).

[10] *Sotera Wireless Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (Precedential as to § II.A) ("*Sotera*").

Patent Owner argues in response that the scheduled trial date still remains nearly six months before the projected deadline for a final written decision in this proceeding and, even if the new median time-to-trial estimates were used, the trial would still be before the November 3, 2025 scheduled trial date. Prelim. Sur-reply 1.

As noted above, when "the court's trial date is earlier than the projected statutory deadline," this has generally weighed "in favor of exercising authority to deny institution." *Fintiv*, Paper 11 at 9. A trial date that is roughly six months[11] earlier than the statutory deadline, on the facts of this case, strongly favors discretionary denial.

3. Factor 3

Fintiv factor 3 looks to the investment in the parallel proceeding by the court and the parties at the time of institution. *Fintiv*, Paper 11 at 9. For example, "if at the time of the institution decision, the district court has issued substantive orders related to the patent at issue in the petition, this fact favors denial." *Id.* at 9–10. Conversely, if "the district court has not issued orders related to the patent at issue in the petition, this fact weighs against exercising discretion to deny institution." *Id.* at 10.

Patent Owner contends that the parties have already exchanged invalidity and infringement contentions, corporate depositions are ongoing,

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[11] In its Response Brief, Petitioner contends that based on the median time-to-trial statistics, the final written decision in this case "would follow trial by ***less than 1 month***—further underscoring that this proceeding would not meaningfully overlap with the district court efforts." Petitioner's Response Brief at 1 (citing Prelim. Sur-reply, 1). Petitioner does not explain how it arrived at this conclusion, however, and the Preliminary Sur-reply to which it cites states that "the updated median trial date would be mid-October 2025, i.e., *still before* the November 3, 2025 scheduled trial date." Prelim. Sur-reply, 1.

and each party has already produced over 5,000 documents. Prelim. Resp. 13. Patent Owner further contends that by the time of the institution decision in this proceeding, 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. *Id.* (citing Ex. 2005, 4–5; Ex. 1038, 3–5). Patent Owner also contends that Petitioner was not diligent in filing the Petition, which was filed "ten months after the complaint was filed, and seven months after the February 23, 2024 order noting Petitioner's waiver of foreign service." *Id.* at 14 (citing Ex. 2009).

Petitioner argues in its Reply that by the institution deadline there will be no court-issued substantive orders related to the '090 patent and fact discovery will remain open. Prelim. Reply 1. Petitioner further contends that the Petition was filed within four months of Patent Owner's amended complaint, which asserted an additional patent and impacted Petitioner's preparation efforts and timeline. *Id.*

Patent Owner contends Petitioner's arguments ignore the fact that the '090 patent was asserted in the original complaint filed ten months before the Petition. Prelim. Sur-reply 1–2 (citing Prelim. Resp. 14; Ex. 2007).

Patent Owner does not persuasively demonstrate that the district court has expended significant efforts related to the '090 patent. *See Fintiv*, Paper 11 at 10 ("If, at the time of the institution decision, the district court has not issued orders related to the patent at issue in the petition, this fact weighs against exercising discretion to deny institution."). The parties, however, have expended a non-trivial level of effort in the district court proceeding, exchanging invalidity contentions and completing claim construction briefing. Ex. 1038, 3–4. Thus, we find that *Fintiv* factor 3 is neutral.

4. Factor 4

Fintiv factor 4 looks to the overlap between issues raised in the petition and in the parallel proceeding. *Fintiv*, Paper 11 at 12.

In the Petition, Petitioner stipulated "not to seek resolution in the district court of the same grounds presented in this Petition." Pet. 79. In its Preliminary Reply, Petitioner strengthens its stipulation, asserting 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*." Prelim. Reply 1–2 (citing Ex. 1044 (stipulation letter)).

Patent Owner contends Petitioner's original stipulation was "essentially meaningless" and, although Petitioner's *Sotera* stipulation favors institution, such a stipulation does not outweigh the other *Fintiv* factors in this case. Prelim. Sur-reply 2.

In its Supplemental Brief, Patent Owner contends that, similar to the petitioner in *Motorola*, "Petitioner's invalidity contentions include combinations of the asserted art with other system art, 'which Petitioner's stipulation is not likely to moot.'" Sup. Brief 1 (citing *Motorola*, Paper 19 at 4; Ex. 2010, 7–8, 52). Petitioner responds that it has "served amended invalidity contentions showing that all challenged claims can be invalidated by testing of system art alone." Petitioner's Response Brief at 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* does not overrule this precedent. Rather, it 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.

Given Petitioner's *Sotera* stipulation, we find that *Fintiv* factor 4 weighs strongly against exercising discretion to deny institution.[12]

5. Fintiv Factor 5

Fintiv factor 5 asks whether the Petitioner and the defendant in the parallel proceeding are the same party. *Fintiv*, Paper 11 at 13–14.

Patent Owner contends this factor weighs in favor of discretionary denial because the parties in the parallel litigation and this proceeding are the same. Prelim. Resp. 16 (citing Pet. 79).

Petitioner agrees that the parties are the same in both proceedings, but contends this factor is "neutral." Prelim. Reply 2.

As noted by Patent Owner in its Preliminary Sur-reply, because the parties are the same in both proceedings, *Fintiv* factor 5 favors discretionary denial. *See Sotera*, Paper 12 at 19; Prelim. Sur-reply 2.

6. Fintiv 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. For example, 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

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[12] For the reasons set forth below, although Petitioner's *Sotera* stipulation weighs strongly against exercising discretion to deny institution, similar to the result in *Motorola*, the stipulation is not sufficient to outweigh the other *Fintiv* factors favoring discretionary denial in this case.

favored denying institution when other factors favoring denial are present." *Id.*

Patent Owner contends this factor weighs in favor of discretionary denial because the Petition fails to present a compelling, meritorious challenge and in addressing this factor the Petition "provides nothing more than a bare statement that 'the Petition presents a compelling case of invalidity.'" Prelim. Resp. 16–17.

Petitioner contends that Patent Owner's assertion that the Petition provides "nothing more than a bare statement" ignores "the robust disclosures of the references in the Petition's multiple grounds." Prelim. Reply 2–3.

We address below whether the Petition presents a "particularly strong" merits challenge or a "close[] call." *Fintiv*, Paper 11 at 14–15.

a. Claims 1–4, 7, 8, and 10 over Shinozaki

Petitioner contends that the subject matter of claims 1–4, 7, 8, and 10 would have been obvious in view of Shinozaki. Pet. 5–38.

i. Shinozaki

Shinozaki discloses an electrolytic copper foil that forms the collector of an electrode for a secondary battery. Ex. 1004 ¶¶ 30–31. This electrolytic copper foil comprises an untreated copper foil that has roughened layers on both the front and back surfaces. *Id.* ¶ 31. The Rz of the roughened layers is 1.0 to 5 μm and the Ra of the roughened layers is 0.25 to 0.7 μm. *Id.* Shinozaki explains that the difference between the roughness Rz of the front and back surfaces should be within 3 μm and the difference of roughness Ra of the front and back surfaces should be within 0.3 μm. *Id.* ¶ 32. When the surface roughness of both surfaces is maintained within these parameters, Shinozaki reports that the adhesion of active material on the surface of the electrolytic copper foil is "good." *Id.* ¶ 45.

Shinozaki discloses six working examples and eight comparative examples. Ex. 1004 ¶ 86, Table 3. The copper foil of Working Example 6 of Shinozaki has Ra values of 0.46 µm (shiny surface, "S") and 0.65 µm (matte surface, "M"), Rz values of 2.80 µm (S) and 4.81 µm (M), and Sm values of 50.00 µm (S) and 30.62 µm (M). *Id.* at Table 3.

ii. Analysis—Claim 1[13]

Petitioner contends that Shinozaki teaches or suggests every limitation of independent claim 1, including an electrolytic copper foil for a secondary battery (element [1pre]) (Pet. 7 (citing Ex. 1004 ¶41; Ex. 1003 ¶ 27)) that comprises an untreated copper foil having front and back surfaces (elements [1a]–[1b]) (*id.* at 8 (citing Ex. 1004 ¶ 31; Ex. 1003 ¶ 28)). With respect to elements [1c]–[1e], Petitioner contends that Rpc is a well-recognized measurement parameter shared among various standards, and was known to reflect the number of peak counts based on an upper criteria line, a lower criteria line, and a unit sampling length. *Id.* at 8–11. Petitioner contends Shinozaki discloses the claimed Rpc values because (1) Shinozaki's Ra and Sm values may be used to derive the Rpc value of, for example, Working Example 6; (2) one of ordinary skill in the art would have used a Gaussian distribution to derive Rpc values for Shinozaki's copper foils; and (3) Rpc is a recognized result-effective variable and one of ordinary skill in the art would have been motivated to optimize Rpc values within the claimed range

[13] Claim 1 is the only independent claim in the '090 patent. Accordingly, we focus our attention on the parties' disputes with respect to claim 1 in each of the proposed grounds.

in order to provide better bonding of active material to the copper foils of Shinozaki. *Id.* at 14–27.

We address each of Petitioner's arguments in turn.

a) Derivation of Rpc in Shinozaki from Ra and Sm Values

Petitioner contends that the Rpc value of Shinozaki's foils can be approximated based on the Sm and Ra values disclosed in the example data of Shinozaki. Pet. 15–16. For example, Petitioner contends that Rpc is related to Sm by the formula Rpc = L/Sm and applying this calculation to Working Example 6 demonstrates that there would be 80 effective peaks (Rpc = 4 mm/ 50.00 μm). *Id.* at 15.

Petitioner concedes that Shinozaki does not disclose an upper criteria line of 0.5 μm or a lower criteria line of -0.5 μm, but contends Shinozaki's Ra value of 0.46 μm may be used to approximate the effect of such upper and lower criteria lines. *Id.* at 15–16. In particular, Dr. Randall testifies that Shinozaki's Ra value of 0.46 μm becomes 0.5 μm when rounded to the number of significant figures disclosed in element [1e] for the upper and lower criteria and "can be used as a 'reliable proxy'" for the upper and lower criteria lines in Working Example 6 of Shinozaki. *Id.* (citing Ex. 1003 ¶ 42). In view of the Ra value of 0.5 μm, Petitioner contends that a person of ordinary skill in the art "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 ±0.5 μm." *Id.* at 16. "Thus," Petitioner contends, "Rpc or the peak count derived above (without considering the upper/lower criteria lines of ±0.5 μm) would be halved when considering Working Example 6." *Id.* (citing Ex. 1003 ¶ 42).

Finally, Petitioner contends that a person of ordinary skill in the art "would have understood that these 40 effective peaks would not always have peaks and valleys which consecutively exceed (e.g., peak-valley-peak-valley consecutive sequence) [the claimed] criteria, so the actual Rpc is likely to be slightly less than, if not equal to, the Rpc estimate of 40 for Working Example 6." *Id.*

Petitioner's argument is not persuasive for several reasons. First, the reference relied upon by Petitioner for the correlation between Rpc and Sm notes that "[w]hen calculating the peak count number, a height discrimination threshold of *RSm* being ± 0.5 µm is recommended." Ex. 1019, 18–19. Shinozaki does not indicate, however, whether an appropriate peak/valley height discrimination threshold was used to calculate its Sm values. Thus, it is not evident that the Sm values of Shinozaki could be used to reliably estimate the Rpc values in Shinozaki.

Second, Petitioner's attempt to overcome the deficiencies in Shinozaki's express disclosures requires numerous estimations, assumptions, and unsupported conclusions. For example, Dr. Randall testifies that Shinozaki's Ra value of 0.46 µm can be rounded to 0.5 µm and then used as a "reliable proxy" for the upper and lower criteria lines. Ex. 1003 ¶ 42. Dr. Randall provides no persuasive evidence, however, to support his conclusion that Ra is a "reliable proxy" for the ± 0.5 µm criteria lines recited in the claims. *Id.* Next, Dr. Randall concedes that the 40 effective peaks of Shinozaki would not always have the peak-valley sequences required by the claims, but nevertheless asserts that the actual Rpc "is likely to be slightly less than, if not equal to, the Rpc estimate of 40 for Working Example 6." *Id.* ¶ 43. Dr. Randall again provides no persuasive explanation or documentary support for such a conclusion, and Patent Owner presents evidence that the number of peaks counted using Sm and Rpc methods can deviate significantly for the same surface. Prelim. Resp. 33–34.

For the foregoing reasons, Petitioner's reliance on multiple insufficiently supported assumptions and conclusions is not sufficient to demonstrate a reasonable likelihood that Shinozaki's Rpc values are within the claimed range when measured using the reference length and peak-valley counting method specified in the claims.

b) Gaussian Distribution

Petitioner contends that the Rpc value of Shinozaki can also be derived using a Gaussian distribution. Pet. 17–22; Ex. 1003 ¶ 44. Dr. Randall testifies that the "Gaussian (normal) distribution has become one of the mainstays of surface classification" and, "[b]ased on performing Gaussian distribution, Table 3 of Shinozaki has been re-developed, and the Rpc of Working Example 6 is estimated to be 39." Pet. 17 (citing Ex. 1003 ¶ 44). Dr. Randall concludes that the estimate of 39 aligns closely with the Rpc of 40 calculated above using the Ra and Sm values reported in Shinozaki. Ex. 1003 ¶ 44.

Dr. Randall's calculations and conclusions are based on, among other things, an assumption that Shinozaki's copper foil follows a Gaussian distribution. Pet. 17–18. Dr. Randall provides some support for his assumption that the surface roughness of Shinozaki's copper foil fits a Gaussian distribution. For example, Dr. Randall presents evidence that products made through random processes, such as electrodeposition, will generally follow the Gaussian form. Ex. 1003 ¶ 51 (citing Ex. 1024, 4 (explaining that whether a surface height distribution is Gaussian or non-Gaussian depends on the nature of the processing method, and surfaces that are formed by the cumulative result of a large number of random discrete processes "will produce a cumulative effect that is governed by the Gaussian form")). Patent Owner presents evidence, however, suggesting that additional confirmational tests should be used to confirm the assumption that the surface roughness of Shinozaki's copper foil follows a Gaussian distribution. Prelim. Resp. 44–45 (citing Ex. 1024, 10 (providing methods to test for Gaussian distribution)). Although this ultimately represents a fact issue best resolved after reviewing cross-examination testimony from both side's declarants (assuming Patent Owner relied upon such testimony during trial), given the evidence provided by Patent Owner and Petitioner's heavy reliance on declarant testimony as opposed to express disclosures in prior art patents or publications, we find the merits challenge based on a Gaussian distribution and "re-developed" Table 3 of Shinozaki is a "close[] call."

c) Result-Effective Variable

Petitioner contends the recited Rpc range of the '090 patent would have been obvious because Rpc is a recognized, result-effective variable known to be correlated with enhancing surface roughness characteristics and with providing void-reduced and uniform copper deposits, "which are related to enhancing adhesion properties of the electrolytic copper foil." Pet. 23 (citing Ex. 1004 ¶¶ 73–74; Ex. 1003 ¶ 62). Petitioner lays out its rationale as follows:

> (1) Rpc is a known spacing parameter that can be controlled "to obtain better bounding of finishes, more uniform finish of plating";
>
> (2) it was known that peak spacing (that is correlated to Rpc via Sm values) is an important factor in the performance of friction surfaces, which is relevant to enhancing mechanical grip (adhesion) between the current collector and the active material of secondary batteries;
>
> (3) it was known that, by controlling Rpc based on Rpc's height characteristics, one could target certain surface profile characteristics, such as Ra;

> (4) in many instances, the objective of controlling Rpc can also be correlated with the objective of controlling Ra (average surface roughness);
>
> (5) it was demonstrated that Rpc is associated with providing void-reduced, smoother, and more uniform copper deposits; and
>
> (6) Rpc values, such as 33.1 and 33.3 in the prior art (Fabian) have been shown to be effective towards enhancing uniformity or void reduction of [a] copper foil surface, which aligns with the design objectives of Shinozaki.

Pet. 26–27 (citing Ex. 1016, 7; Ex. 1005, 8, 11, Figs. 8, 11; Ex. 1004 ¶ 73; Ex. 1003 ¶ 66).

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012) (*quoting In re Aller*, 220 F.2d 454, 456 (CCPA 1980)). This rule, however, is limited "to cases in which the optimized variable is a 'result-effective variable.'"

Although Petitioner demonstrates that surface roughness measures, such as Rz and Ra, were known to affect adhesion, whether Rpc was understood in the art to be a result-effective variable with respect to adhesion of active material to electrolytic copper foils is unclear. First, we are not directed to any prior art reference that actually ties Rpc to improved surface adhesion of active material on an electrolytic copper foil. Rather, as outlined above, Petitioner must take multiple inferential steps to arrive at that conclusion. Pet. 25–27.

Petitioner asserts that Fabian[14] discloses PPC values (33.1 and 33.3) that fall within the claimed range, but there is insufficient evidence of record to suggest that Fabian uses the upper and lower height criteria recited in claim 1 of the '090 patent. Prelim. Resp. 51. Petitioner acknowledges this point, but asserts that DIN EN ISO 4287 (Ex. 1019, 20–21) states that use of ±0.5 µm is "recommended" and "Fabian should have followed this recommendation." Pet. 27 n.8. There is no persuasive evidence in this record, however, to support a conclusion that Fabian was applying the DIN EN ISO 4287 standard and/or its recommended peak-valley criteria of ±0.5 µm. As such, it is not clear that Fabian's PPC values correlate to values falling within the Rpc range recited in claim 1 of the '090 patent.

Upon review of Petitioner's result-effective variable analysis, we conclude that it does not present a particularly strong case on the merits, but rather a "close[] call." *Fintiv*, Paper 11 at 15.

d) Conclusion—Shinozaki

For the reasons outlined above, we conclude that Petitioner's ground based on Shinozaki is not "particularly strong," but rather presents a "close[] call."

b. Claims 1–4, 7, 8, and 10 in view of Sano and Griesi

Petitioner contends that the subject matter of claims 1–4, 7, 8, and 10 would have been obvious in view of the combined disclosures of Sano and Griesi. Pet. 45–60.

[14] C.P. Fabian, et. al., *Assessment of activated polyacrylamide and guar as organic additives in copper electrodeposition*, Hydrometallurgy 86, 44–45 (2007). Ex. 1005 ("Fabian").

i. Sano

Sano discloses an "electrodeposited copper foil with low roughness surface" that is "applicable in printed-wiring boards or cathode collectors of lithium secondary batter[ies]." Ex. 1008 ¶ 1. Sano explains that the disclosed copper foils have a low surface roughness Rz that is 2.0 µm or less and the difference in roughness between the two surfaces of the foil is minimized. *Id.* ¶¶ 5, 6, 8, 12, 13.

ii. Griesi

Griesi is a Master's Thesis by Michael B. Griesi and is titled "Characterization of Electrodeposited Copper Foil Surface Roughness for Accurate Conductor Power Loss Modeling." Ex. 1015, 1. As part of his analysis, Griesi investigated several methods for characterizing or viewing the surface of a treated copper foil, including the use of a mechanical profilometer (Perthometer). *Id.* at 37–38. Figure 3.16 of Griesi is reproduced below:

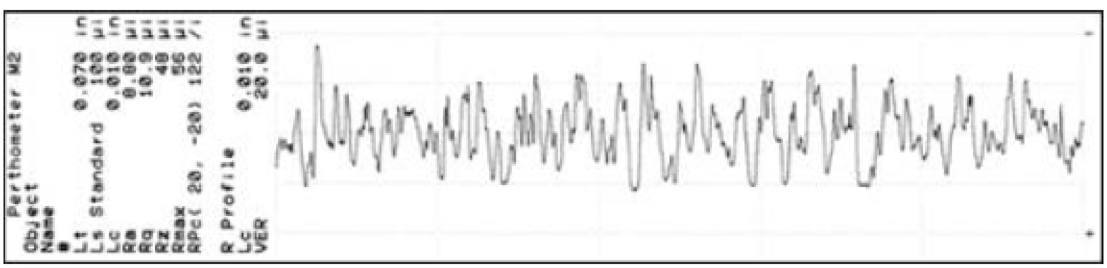

Figure 3.16, above, depicts a "Printed Perthometer Surface Profile of Raw Untreated Copper Foil." *Id.* at 38. On the left side of the printed receipt are values for Rz (48 µin) and RPc (122 peaks/in at criteria lines of 20, -20 µin), which Dr. Randal testifies equate to an Rz of 1.2 µm and an Rpc of 19.2 peaks per 4 mm using criteria lines of +0.5 µm and -.05 µm. *Id.*; Ex. 1003 ¶ 131.

iii. Analysis – Claim 1

Petitioner contends that one of ordinary skill in the art would have found it obvious to use Griesi's Rpc value of 19.2 for the copper foil of Sano. Pet. 49–50. Petitioner reasons that both Sano and Griesi disclose Rz values of less than 2 µm, and one of ordinary skill in the art "looking to further optimize Sano's copper foil surface (which can serve as a starting point) would have considered Griesi's surface roughness profile data" and would have recognized the "Rpc in Griesi as a potentially useful parameter that could further enhance uniformity or generally improve Sano's copper foil surface." *Id.* at 50.

Although Dr. Randall demonstrates that Griesi's Rpc value is 19.2 over a 4 mm sampling length (Ex. 1003 ¶ 131), Petitioner does not contend that Griesi addresses this value or indicates any benefit that might be derived from its use. Instead, the Rpc value appears to be an incidental finding, which is not discussed or analyzed in the reference. Petitioner does not persuasively explain why such an incidental, unexamined finding would lead one of ordinary skill in the art to import Griesi's Rpc value into the foil of Sano, absent a hindsight desire to reconstruct the claimed invention. As such, Petitioner's arguments with respect to Sano and Griesi are not persuasive.

c. Claims 1–11 over Dobashi

Petitioner contends that the subject matter of claims 1–11 would have been obvious in view of Dobashi. Pet. 64–77.

i. Dobashi

Dobashi discloses a surface-treated electro-deposited copper foil. Ex. 1007 ¶ 46. Dobashi explains that the maximum peak to valley height (PV) of the bonding surface is preferably 0.05 µm to 1.5 µm, and more preferably 0.05 µm to 0.8 µm. *Id.* ¶ 56. Dobashi further explains that the surface roughness (R_{ZJIS}) of the bonding surface is preferably 0.1 µm to 1.0 µm, and more preferably 0.1 µm to 0.5 µm, and the "RSm obtained together with the measurement of R_{ZJIS} is further preferably more than 0.1." *Id.* ¶ 57.

ii. Analysis—Claim 1

Petitioner contends that the Rpc of Dobashi's copper foil can be obtained from other surface roughness parameters, such as Rsm or Sm, and the claimed Rpc values would have been obvious because "Dobashi's teachings about surface roughness covers Rpc that fall within the claimed range." Pet. 67. Using Dobashi's surface profile measurements of R_{ZJIS} = 0.1–1.0 µm; PV = 0.05–1.5 µm; and Rsm > 0.1 µm, Dr. Randall "manually generated hypothetical surface profiles that satisfy Dobashi's teachings of Rz_{JIS}, PV, and Rsm" and "at the same time can be converted to Rpc values of 10, 15, and 20, which all fall within the claimed range." *Id.* at 68–69.

Petitioner's second hypothetical data set is reproduced below:

	2nd Data Set (*See* other data sets at SOLUS-1003, ¶¶205, 207) Rz = 1.0 µm, PV = 1.2 µm, Rsm > 0.1 mm, sampling length 0.8mm → Rpc ≈ 15 / 4mm				
5 Highest Peaks from mean line	0.6	0.4	0.3	0.6	0.6
5 Deepest Valleys from mean line	-0.6	-0.4	-0.3	-0.6	-0.6
As these are highest peaks and deepest valleys of surface profile, other existing peaks cannot be higher than 0.3 and deeper than -0.3. This indicates that there can't be any more peaks rise above +0.5µm or descend below -0.5 µm about the mean line in this sample (with sampling length of 0.8 mm) **So in these data it is definite that there are 3 effective peaks (Rpc= 3) per sampling length of 0.8 mm, and when sampling length is 4mm, Rpc =15					

Pet. 69 (citing Ex. 1003 ¶ 206). In the data set above, Petitioner provides a hypothetical set of 5 highest peaks and 5 deepest valleys that would result in a Rz = 1.0 µm, PV = 1.2 µm, and Rsm > 0.1 µm, with a sampling length of 0.8 mm.

Although Dobashi does not disclose Rpc values for its copper foils, Dr. Randall demonstrates that one could generate hypothetical values for a copper foil that has Dobashi's Rz, PV, and Rsm values and also has an Rpc of, for example, approximately 15. Dr. Randall does not, however, demonstrate that the copper foils of Dobashi actually have such properties. Indeed, Patent Owner presents evidence that the actual working examples disclosed in Dobashi could not have Rpc values within the claimed range because no set of peaks or valleys in these example foils could exceed ±5 µm (as required by independent claim 1), as their PV and Rz_{JIS} values are less than 1 µm. Prelim. Resp. 57 (citing Ex. 1007, Table 2).[15]

In view of the foregoing, Petitioner's arguments with respect to Dobashi are not persuasive.

d. Conclusion With Respect to Fintiv Factor 6

For the reasons set forth above, the Petition presents, at best, a close call on the merits. Accordingly, we find that this factor favors discretionary denial.

7. Balancing the Fintiv 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* factor 2 weighs strongly in favor of discretionary denial; *Fintiv* factors 5 and 6 favor discretionary denial; *Fintiv* factors 1 and 3 are neutral; and

[15] Petitioner also contends it would have been obvious to use Rpc values within the claimed range in Dobashi in view of Rpc being a known, result-effective variable. Pet. 69–70. This argument is not particularly persuasive for the reasons set forth above with respect to Petitioner's ground based on Shinozaki.

Fintiv factor 4 weighs strongly against discretionary denial. Weighing these various factors, and in particular the close case on the merits, we determine that the evidence of record favors exercising our discretion under 35 U.S.C. § 314(a) to deny institution of an *inter partes* review.

B. Discretionary Denial Pursuant to 35 U.S.C. § 325(d)

Petitioner also contends that we should discretionarily deny the Petition under 35 U.S.C. § 325(d) because the same or substantially the same art and arguments were before the Examiner during prosecution and Petitioner's has not demonstrated that the Examiner erred in a material manner when allowing the claims. Pet. 17–18.

Given our discretionary denial of the Petition in view of the *Fintiv* factors, we do not address Petitioner's further arguments with respect to § 325(d).

V. CONCLUSION

For the reasons set forth above, we find that the *Fintiv* factors favor exercising our discretion to deny institution under 35 U.S.C. § 314(a).

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied* and no trial is instituted.

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