

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.

IPR2025-00005
Patent 9,457,541 B2

Before RAE LYNN P. GUEST, JOHN G. NEW, and
JO-ANNE M. KOKOSKI, *Administrative Patent Judges*.

NEW, *Administrative Patent Judge*.

DECISION

Denying Petitioner's Request on Rehearing
of Decision Denying Institution of *Inter Partes* Review
37 C.F.R. § 42.71(d)

I. INTRODUCTION

Petitioner Solus Advanced Materials Co., Ltd. (“Petitioner”) filed a Request for Rehearing (Paper 15, “Req.” or “Request”) of our Decision (Paper 14, “Dec.” or “Decision”) denying institution of *inter partes* review of claims 1–4 of U.S. Patent No. 9,457,541 (Ex. 1001, the “’541 Patent”) in this proceeding.

In the Decision, we denied the Petition (Paper 2) upon concluding that Petitioner had not demonstrated a reasonable likelihood of prevailing at trial. *See* Dec. 9–58. Petitioner now argues that: (1) the Board misapprehended or overlooked Petitioner’s arguments regarding the Lowenheim reference¹ and a person of ordinary skill’s reasonable expectation of success in arriving at the claimed invention; and (2) the Board misapprehended or overlooked Petitioner’s evidence regarding the Ye reference.² Req. 3, 7.

For the reasons that follow, Petitioner’s Request is denied.

II. STANDARD OF REVIEW

When rehearing a decision on institution, we do not review the merits of the decision *de novo*, but instead review the decision for an abuse of discretion. 37 C.F.R. § 42.71(c). An abuse of discretion may be determined “if a decision is based on an erroneous interpretation of law, if a factual finding is not supported by substantial evidence, or if the decision represents an unreasonable judgment in weighing relevant factors.” *Arnold*

¹ F.A. Lowenheim, *MODERN ELECTROPLATING* (Wiley 1974) (“Lowenheim”) Ex. 1025.

² X. Ye et al., *Role of Overpotential on Texture, Morphology and Ductility of Electrodeposited Copper Foils for Printed Circuit Board Applications*, 139(6) J. ELECTROCHEM. SOC. 1592–1600 (1992) (“Ye”) Ex. 1013.

Partnership v. Dudas, 362 F.3d 1338, 1340 (Fed. Cir. 2004) (citing *In re Gartside*, 203 F.3d 1305, 1315–16 (Fed. Cir. 2000)). The party requesting rehearing has the burden to show that the decision should be modified. 37 C.F.R. § 42.71(d). Additionally, the request for rehearing “must specifically identify all matters the party believes the Board misapprehended or overlooked, and the place where each matter was previously addressed in a motion, an opposition, or a reply.” *Id.*

III. ANALYSIS

A. *Reasonable expectation of success*

1. Petitioner’s arguments

Petitioner alleges that, in concluding that Petitioner failed to establish a reasonable expectation of success in achieving the claimed copper foil properties, the Board’s Decision misapprehended the overall interpretation of the evidence, including the Lowenheim reference and Dr. Josefowicz’s related testimony.³ Req. 4 (citing Dec. 56–58). Petitioner disputes the Board’s finding that Dr. Josefowicz’s testimony was “largely unsupported by evidence of record,” and that Lowenheim’s Table 2 disclosed tensile strengths “well outside the claimed range.” Req. 4 (citing Dec. 56–57).

Petitioner contends that Lowenheim’s Table 2 clearly discloses multiple tensile strength ranges that fall within or overlap the claimed range of 30 to 40 kgf/mm², including under “Hardness” (3.5–55.5 kgf/mm²),

³ Petitioner notes that Lowenheim, which was not cited as the basis for any of the Petition’s Grounds 1–3, was instead cited as providing: (1) context for the state of the art at the time of the earliest priority date of the ’541 patent; and (2) support for the reasonable expectation of success.

“Good leveling” (36–36.5 kgf/mm²), and “Thermal stability” (22.5–30 kgf/mm²) categories. Req. 4 (citing Pet. 15–17, 46, 56–57; Ex. 1003, ¶¶ 63–64, 123–124, 180–181 (citing Ex. 1025, Table 2). Lowenheim’s Table 2 is reproduced below:

Table 2. PROPERTIES OF COPPER ELECTRODEPOSITS USEFUL FOR DIVERSE APPLICATIONS

Outstanding Characteristic	Tensile Strength, kg/mm ²	Elongation, % (5cm)	Internal Stress, ^c kg/mm ²	Hardness (VHN ₂₀₀), kg/mm ²	Electrical Resistivity, microhm-cm
High strength	45–63.5	4–18	–4.2 or 3.6 to 5.5	131–159	1.75–2.02
Hardness	3.5–55.5	0–10	–4.2 or 3.0	193–350	1.96–4.60
Low electrical resistivity	18.5–27	15–41	–0.5 to –1.6	48–64	1.70–1.73
Near zero stress	14–16	8–24	–0.08–0.06	56–57	1.71–1.72
Good leveling	36–36.5	14–19	2.0	128–137	1.82
Thermal stability ^b	22.5–30	26–39	0.5–2.9	55–106	1.73–1.76

^aNegative values indicate a compressive stress.
^bDeposits that changed less than 0.02% in length after heating to 403°C.

Petitioner notes that, in its Preliminary Response (“Prelim. Resp.” Paper 8), Patent Owner solely focused on the “High strength” range (45–63.5 kgf/mm²), omitting any discussion of these other relevant categories. Req. 4. Petitioner argues that the Board adopted Patent Owner’s reasoning without addressing the broader disclosure that aligns with Dr. Josefowicz’s testimony. *Id.* at 4–5.

Petitioner argues further that Lowenheim’s Table 2, its accompanying discussion, and its 1974 publication date, reflect a skilled artisan’s contemporaneous understanding that achieving various tensile strength values was a matter of routine optimization. Req. 5 (citing Pet. 15–17, 46, 56–57; Ex. 1003 ¶¶ 63–64, 123–124, 180–181; Ex. 1025, 17–18, Table 2). According to Petitioner, the accompanying discussion to Table 2 describes how process variables, such as electrolyte type, additive composition, bath

temperature, and use of reverse current, were used to tune the copper foil properties, as of 1974. *Id.* (citing Pet. 15–17, 46, 56–57; Ex. 1003 ¶¶ 63–64, 123–124, 180–181; Ex. 1025, 17, 18, Table 2, 17).

Petitioner also disputes the Board’s finding that Lowenheim disclosed tensile strengths “well outside the claimed range.” Req. 6 (citing Dec. 56–57). According to Petitioner, a full and accurate reading of Lowenheim supports Dr. Josefowicz’s testimony that “at least since 1974,” “it was conventional” in the art to tune copper foil properties by varying the electrolyte concentration, electrolysis conditions, and/or the deposition conditions. *Id.* (citing Pet. 15–17, 46, 56–57; Ex. 1003 ¶¶ 63–64, 123–124, 180–181). In arguing that a skilled artisan would have had a reasonable expectation of success in arriving at the claimed invention, Petitioner relies upon Dr. Josefowicz’s conclusion that:

[T]he optimization of weight deviation, elongation, tensile strength, and RZ values in copper foil would have involved a mere routine optimization of electrodeposition conditions, such as varying concentrations of additives (e.g., organic additives), electrolysis solution chemistry, which includes copper sulfate and sulfuric acid, treatment time, and/or current density and other plating parameters such as solution agitation and temperature.

Id. (quoting Ex. 1003 ¶ 63; and citing Pet. 15–17, 46, 56–57; Ex. 1003 ¶¶ 63–64, 123–124, 180–181).

2. Analysis

We are not persuaded by Petitioner’s arguments that we either overlooked or misapprehended Lowenheim, Dr. Josefowicz’s related testimony, or other evidence of record cited by Petitioner. In our Decision, we stated:

[T]his Ground [Ground 3] provides us with a somewhat closer call, if only because all of the references are drawn to copper foils for use as anodal current collectors. Nevertheless, the fundamental flaw of Petitioner's argument persists in that Petitioner fails to articulate a reason why a person of ordinary skill in the art would have had a reasonable expectation of success in combining the references to arrive at the claimed invention.

Dec. 56. As we explained:

At the heart of this flaw is Petitioner's argument, and Dr. Josefowicz's opinion, that it would have been conventional in the art at the time of filing to vary the electrolyte concentration, electrolysis plating parameters, temperature, and the use of organic and inorganic additives, in order to obtain a copper foil with tensile strength and elongation values falling within the claimed ranges as these ranges were well known, at least since 1974. Ex. 1003 ¶ 63. This statement is largely unsupported by evidence of record, with the sole exception of Table 2 of Lowenheim, which, as Patent Owner points out, provides tensile strengths well outside the claimed range. Petitioner provides insufficient guidance as to how a person of ordinary skill in the art would have known which parameters to vary, or how to vary them, *to provide the foil of Hirose with a tensile strength or weight deviation within the claimed range*. Dr. Josefowicz's statement that this would result from routine optimization, and was "conventional" may or may not be true, but it is insufficiently supported by evidence of record to be persuasive.

Id. (emphasis added) (footnote omitted).

Referring to Table 2 of Lowenheim, Dr. Josefowicz testified that:

[T]he optimization of weight deviation, elongation, and tensile strength values in copper foil would have involved a mere routine optimization of electrodeposition conditions, such as varying concentrations of additives (e.g., organic additives), electrolysis solution chemistry, which includes copper sulfate and sulfuric acid, treatment time, and/or current density and other plating parameters such as solution agitation and temperature. See ¶¶ 30–38. For example, it was conventional to vary the

electrolyte concentration, electrolysis plating parameters, temperature, and the use of organic and inorganic additives, in order to obtain a copper foil with tensile strength and elongation values falling within the claimed ranges as these ranges were well known, at least since 1974.

Ex. 1003 ¶ 63; *see also id.* ¶¶ 123 (same), 180 (same). Dr. Josefowicz concluded that “[t]hus, it is my opinion that a POSITA would have been motivated to apply or optimize weight variation, tensile strength, and elongation features on Kim’s electrolytic copper foil and expected success.” *Id.* ¶ 64; *see also id.* ¶¶ 124 (same), 181 (same).

We acknowledge Petitioner’s argument that Table 2 of Lowenheim teaches the tensile strengths of various types of copper-electroplated steel electrical cable wire of different properties, including high strength, hardness, low electrical resistivity, near zero strength, good leveling, and thermal stability, some of which fall within the claimed range of tensile strength of 30 to 40 kgf/mm². Lowenheim, 196, Table II. However, none of these categories correspond to those copper foil properties recited in the claims, and Dr. Josefowicz’s testimony provides little guidance as to how a person of ordinary skill in the art would have known how to optimize the recited properties, and particularly so in combination with the teachings of Hirose and the other cited prior art references. Furthermore, as we noted in our Decision:

Patent Owner asserts that this interplay between *crystal structure texture coefficients, crystal structure grain size, and tensile strength* is overlooked by Petitioner and Dr. Josefowicz. Prelim. Resp. 45. Patent Owner argues that Petitioner’s own art explains *that these foil properties cannot be simply mixed and matched to achieve a desired foil.*

Dec. 45 (emphasis added). And as we explained in more detail with respect to Dr. Josefowicz's same testimony with respect to claim 1 in Ground 1:

[A]lthough each property may be desirable and separately optimized *via* varying one or more process parameters, Petitioner has not shown a reasonable expectation of success that *all* of the recited properties, including the particular crystal structure, as well as weight deviation, elongation, and tensile strength, would have been reasonably expected to be achieved in a single product without the hindsight of the '541 patent.

Dec. 39 (citing Ex. 1003 ¶ 63) (emphasis in original).

Therefore, and despite Dr. Josefowicz's stated conclusion that the foil properties recited in claim 1 could have been achieved *via* routine optimization, we concluded that Dr. Josefowicz's testimony was insufficiently supported by evidence of record to sustain that conclusion. *See* Dec. 56–57.

Moreover, and as we stated in our Decision:

Petitioner is plucking various properties of copper foils from various references, each of which employs significantly different starting materials and methodologies, and, without sufficient persuasive evidence of record, asserting that a person of ordinary skill in the art would know how to vary a number of different interacting operational variables (e.g., electrolyte concentration, electrolysis plating parameters (including voltage, current, duration, and temperature), and the use of organic and inorganic additives) to result in a foil having all of the combined properties recited in challenged claim 1.

Dec. 57.

In summary, we again conclude that Petitioner has failed to provide sufficient evidence to demonstrate that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the cited prior art references, in combination with Dr. Josefowicz's relatively

unsupported testimony concerning a skilled artisan’s ability to optimize various constituents and conditions, to arrive at the claimed invention. Petitioner has not pointed to any argument or unconsidered evidence of record that is sufficient to show that, in reaching its conclusion, the Board abused its discretion by basing its Decision on an erroneous interpretation of law, a factual finding not supported by substantial evidence, or an unreasonable judgment in weighing relevant factors. *Arnold*, 362 F.3d at 1340.

B. *The Ye reference*

1. Petitioner’s argument

Petitioner argues that Ye discloses a set of electrolytic copper foils associated with “understanding how different factors affect the quality of electrolytic copper foils and how the ‘overpotential’ ... and other parameters ... influence the texture, surface roughness, and flexibility.” Req. 7 (citing Pet. 32–34, 39–42; Ex. 1003 ¶¶ 106–109, 126–132. Petitioner points to Ye’s Sample No. 15 as one of this set of electrolytic copper foils that falls within Ye’s teachings and disclosed embodiments.⁴ *Id.* (citing Pet. 32–34, 39–42; Ex. 1003 ¶¶ 106–109, 126–132).

Petitioner notes that Ye is the primary reference in the Ye-Hara-Otsuka combination, and argues that a person of ordinary skill in the art would have reasonably considered any of the samples of its disclosed

⁴ Petitioner also states that the disclosure of the various embodiments of Ye “do not constitute any teaching away.” Req. 7 (citing MPEP § 2123 (citing *In re Susi*, 440 F.2d 442 (C.C.P.A. 1971))). Because the Decision does not raise the issue of whether the embodiments of Ye teach away from the claimed invention, we do not address that issue here.

example as a viable starting point. Req. 7–8 (citing *Pfizer, Inc. v. Apotex, Inc.*, 480 F. 3d 1348, 1368 (Fed. Cir. 2007)). Petitioner contends that the selection of Ye’s Sample No. 15 is not based on hindsight, but rather reflects the straightforward selection of a disclosed sample that falls within Ye’s embodiments and teachings. *Id.* at 8 (citing Pet. 32–34, 39–42; Ex. 1003 ¶¶ 106–109, 126–132; also citing *In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012)).

Petitioner argues that its reliance on Dr. Josefowicz’s testimony and related evidence to support the combination based on Ye’s Sample No. 15 as a base system is therefore proper, because that testimony “takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant’s disclosure.” Req. 8 (quoting *In re McLaughlin*, 443 F.2d 1392, 1395 (C.C.P.A. 1971)).

Finally, Petitioner argues that, even if only a subset of Ye’s samples satisfies the claims, that is sufficient to support a conclusion of obviousness. Req. 9 (citing *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016); *Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003)).

2. Analysis

We are not persuaded by Petitioner’s arguments that the Board abused its discretion upon this issue. As we explained in the Decision:

[O]f the 44 specimens tested by Ye, as revealed in Ye’s Table II, only a single specimen, specimen 15, meets the required TC ratios recited in challenged claim 1 of the ’541 patent. Furthermore, none of the references cited by Petitioner teach, or even remotely suggest, the four requisite TC ratios recited by

challenged claim 1. We find Petitioner's argument that a person of ordinary skill in the art would have been motivated to exclusively select Ye's sample 15, out of the remaining 43, to which to apply the teachings of Hara and Otsuka concerning the requisite tensile strength and weight deviation ranges in the hope of arriving at the claimed invention, is implausible. Indeed, only the '541 patent, among all of the evidence of record, that actually mentions the required texture coefficient ratios recited in challenged claim 1. Petitioner provides no convincing argument as to why a skilled artisan would have selected sample 15 for combination with Hara and Otsuka.

Dec. 47.

We concluded that "Petitioner's failure to suggest a reason as to why a person of ordinary skill in the art would have been motivated to select that single specimen, without knowledge of the specific TC ratios disclosed by the '541 patent, argues against Petitioner's contention that the claims are obvious." Dec. 48.

In other words, we were not persuaded by Petitioner's arguments relying upon Ye, because only a single example, Sample 15, out of the forty-four samples of Ye's Table II could satisfy the claimed TC ratios recited in challenged claim 1. *See also* Ye, Table I. Those TC ratios were nowhere previously described in the evidence of record, or cited by Petitioner, but were disclosed only in the Specification and claims of the '541 patent. Our conclusion of obviousness, therefore, and as we expressly held in the Decision, is based upon our finding that Petitioner had failed to suggest a reason as to why a person of ordinary skill in the art would have been motivated to select that particular exemplary foil, without hindsight knowledge of the specific TC ratios disclosed by the '541 patent. Dec. 48. Furthermore, and as we expressly stated in the Decision, Petitioner has provided no persuasive reason why a skilled artisan would have been

motivated to combine Ye's sample 15, and only sample 15, with the teachings of Hara and Otsuka. *Id.* at 47.

Consequently, we are not persuaded by Petitioner's argument that the Board abused its discretion by overlooking or misapprehending this matter. 37 C.F.R. § 42.71(d).

IV. CONCLUSION

We have reviewed and considered the arguments in Petitioner's Request, and conclude that Petitioner has not met its burden of demonstrating that we abused our discretion in denying institution of *inter partes* review of the challenged claims of the '541 patent. 37 C.F.R. § 42.71(d).

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner's Requests for Rehearing is denied.

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For PETITIONER:

Timothy W. Riffe
Hyun Jin In
FISH & RICHARDSON P.C.
riffe@fr.com
in@fr.com
IPR57533-0005IP1@fr.com

PATENT OWNER:

James M. Glass
Quincy Lu
David Elihu
Michael Specht
Daniel Yonan
Jason Fitzsimmons
Jennifer Chagnon
Chase Hammond
QUINN EMANUEL URQUHART & SULLIVAN LLP
jimglass@quinnemanuel.com
quincylu@quinnemanuel.com
davideliu@quinnemanuel.com
qe-skn-solus-ipr@quinnemanuel.com
mspecht-ptab@sternekessler.com
dyonan-ptab@sternekessler.com
jfitzsimmons-ptab@sternekessler.com
jchagnon-ptab@sternekessler.com
chammond-ptab@sternekessler.com