

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO. LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
SAMSUNG SEMICONDUCTOR, INC., and
SAMSUNG AUSTIN SEMICONDUCTOR, LLC,

Petitioner

v.

CHIEN-MIN SUNG,

Patent Owner

IPR2024-00533
U.S. Patent No. 8,974,270

PATENT OWNER'S RESPONSE UNDER 37 C.F.R. § 42.120

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Submitted Electronically via PTACTS

TABLE OF EXHIBITS

Exhibit	Description
2001	[Intentionally omitted.]
2002	[Intentionally omitted.]
2003	[Intentionally omitted.]
2004	Declaration of Prof. Ming-Yi Tsai
2005	“The Organic Diamond Disk (ODD) for dressing of Polishing Pads of Chemical Mechanical Planarization,” International Conference on Planarization / CMP Technology, 25-27 October 2007
2006	M. Y. Tsai & Y. S. Liao (2009) Dressing Characteristics of Oriented Single Diamond on CMP Polyurethane Pad, Machining Science and Technology, 13:1, 92-105
2007	M. Y. Tsai et al., Novel Diamond Conditioner Dressing Characteristics of CMP Polishing Pad, International Journal of Machine Tools & Manufacture 49 (2009) 722–729
2008	Kuen-Ren Chen & Hong-Tsu Young, Estimation of Dressing Effects in Chemical Mechanical Polishing with Sorts of Diamond Dressers, Advanced Materials Research Online: 2009-06-24 ISSN: 1662-8985, Vols. 76-78, pp 175-180
2009	Hsiu-Ming Yeh & Kuo-Shen Chen, Development of a pad conditioning simulation module with a diamond dresser for CMP applications, Int J Adv Manuf Technol (2010) 50:1–12
2010	Pysher et al. “Design, Characteristics and Performance of Diamond Pad Conditioners”, Materials Research Society Symposium Procedures, Vol. 1249, 2010 (“Pysher”)

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Pursuant to 37 C.F.R. § 42.120, Patent Owner Chien-Min Sung (“Patent Owner,” “PO,” or “Dr. Sung”) submits his Patent Owner’s Response to the Petition for *Inter Partes* Review (“Petition”) by Petitioners Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC (collectively, “Petitioners” or “Samsung”).

I. INTRODUCTION

Petitioners contend that the challenged claims of U.S. Patent No. 8,974,270 (the “’270 patent”) are rendered obvious. Petitioners must therefore establish, by a preponderance of the evidence, that each challenged claim is unpatentable based on the specific invalidity theories and supporting evidence identified with particularity in the Petition. But for each Ground in this Proceeding, Petitioners have failed to carry that burden. Simply put, the obviousness arguments set forth in the Petition fall short of what is required to establish invalidity.

First, Petitioners’ reference Sung ’479 (defined below) is not enabling to teach “the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns,” as recited in claim 1. As Sung ’479 is the only reference alleged to teach this claim language, this lack of enablement is fatal to the Petition.

Second, Petitioners' cited references do not teach or suggest "a first monolayer of superabrasive particles . . . , wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns," as recited in claim 1.

Finally, Petitioners fail to meet their burden regarding any motivation to combine the cited references.

Because Petitioners have failed to show the unpatentability of any of the claims challenged in the Petition by a preponderance of the evidence, each of the three Grounds in this Proceeding should be rejected in its entirety.

II. THE CITED REFERENCES

The Petition cites the following references:

- U.S. Patent Application Publication No. 2010/0022174 ("Chou") (Ex. 1004), published January 28, 2010;
- U.S. Patent Application Publication No. 2008/0096479 ("Sung '479") (Ex. 1005), published April 24, 2008;
- U.S. Patent Application Publication No. 2008/0004743 ("Goers") (Ex. 1006), published January 3, 2008; and

- Sung et al. “Polycrystalline Diamond (PCD) Shaving Dresser: The Ultimate Diamond Disk (UDD) for CMP Pad Conditioning,” *ECS Transactions*, 18 (1) 523-528 (2009) (“SungECS”) (Ex. 1007), published March 6, 2009.

III. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA for purposes of the '270 patent would have had at least a bachelor's degree in mechanical engineering or other related field of engineering and at least two years of experience in developing CMP technology including some specific experience with the design and development of CMP pad dressers. (Ex. 2004 at ¶29.) Petitioner's definition is overly broad as it merely requires experience “in the field of integrated circuit processing and fabrication techniques,” as opposed to any specific experience with the design and development of CMP pad dressers. (Ex. 2004 at ¶28.) The '270 Patent states upfront that “the present disclosure provides CMP pad dressers and associated methods thereof.” (Ex. 1001 at 1:28-29.) Therefore, a POSITA would have necessarily had specific experience with the design and development of CMP pad dressers, including the background and progression of CMP design as outlined below, and would have been able to apply that knowledge to the context of the '270 patent. (Ex. 2004 at ¶28.)

Patent Owner contends that Dr. Shanfield's lack of that specialized experience (*see* Ex. 1002, App'x A) disqualifies him as a POSITA. At most, Dr. Shanfield states that he has generally worked with CMP systems at facilities where he worked (*id.* ¶¶ 3-5), but he does not profess any experience related to the design and development of pad dressers. For at least this reason, Dr. Shanfield's testimony should be given little, if any, weight.

IV. CLAIM CONSTRUCTION

Claims in an *inter partes* review are construed using the same claim construction standard as in a civil action—i.e., in accordance with their ordinary and customary meaning as understood by a POSITA. 37 C.F.R. § 42.100(b). The POSITA is deemed to read the claim term in the context of the entire patent, including the specification and prosecution history. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313-16 (Fed. Cir. 2005) (*en banc*). Indeed, claims must be construed so as to be consistent with the specification. *Id.*

The Petition alleges that no express constructions of the claims are necessary to assess whether the cited art reads on the challenged claims. (Pet. at 19-20.) However, Petitioners then argue that Patent Owner acted as its own lexicographer to define “superabrasive,” “protrusion,” “sharp portion,” and “attitude.” (Pet. at 20-21.)

Patent Owner contends that no construction is necessary for the '270 patent's claim terms.

V. LEGAL STANDARDS

“In an inter partes review, the burden of persuasion is on the petitioner to prove ‘unpatentability by a preponderance of the evidence,’ 35 U.S.C. § 316(e), and that burden never shifts to the patentee.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016). Specifically, the Petition must “identif[y] in writing **and with particularity**, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3); *see also Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“[i]t is of the utmost importance that petitioners . . . adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’”).

In addition, the Board must make its determinations based on what the Petition **actually presents** and not what it could have reasonably contained had it been reformulated. *Magnum Oil*, 829 F.3d at 1381 (holding that the Board is **not** “free to adopt arguments on behalf of petitioners that could have been, but were not, raised by the petitioner during [a post-grant proceeding]”). The Board cannot “deviate

from the grounds in the petition and raise its own” theories of invalidity. *Sirona Dental Sys. GmbH v. Institut Straumann AG*, 892 F.3d 1349, 1356 (Fed. Cir. 2018).

Review has been instituted based on grounds raising 35 U.S.C. § 103. To prevail on obviousness under 35 U.S.C. § 103, Petitioner must demonstrate based on “record evidence” that the claimed “structural features . . . were known prior art elements.” *K/S Himpp v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365 (Fed. Cir. 2014). “[W]hile ‘common sense’ can be invoked, even potentially to supply a limitation missing from the prior art, it must still be supported by evidence and a reasoned explanation.” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016). “To render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention.” *Raytheon Techs. Corp. v. GE*, 993 F.3d 1374, 1380 (Fed. Cir. 2021) (citing *In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005)). “In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon. In this context the reference must necessarily enable the relied-upon portion of its own disclosure—the same standard applied to anticipatory references.” *Id.* at 1381 (citations omitted). “[I]f an obviousness case is based on a non-self-enabled reference, and no other prior art

reference or evidence would have enabled a skilled artisan to make the claimed invention, then the invention cannot be said to have been obvious.” *Id.* at 1377.

Moreover, “[o]bviousness requires more than a mere showing that the prior art includes separate references covering each separate limitation in a claim.” *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). “Rather, obviousness requires the additional showing that a [POSITA] at the time of the invention would have selected and combined those prior art elements in the normal courses of research and development to yield the claimed invention.” *Id.* And, Petitioners have the burden to demonstrate “that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–1368 (Fed. Cir. 2016); *see also In re Stepan Co.*, 868 F.3d 1342, 1345–46 (Fed. Cir. 2017). These additional requirements cannot be met by “conclusory statements”—“there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006); *see also KSR Int’l. Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

VI. BACKGROUND OF CMP PAD DRESSER DEVELOPMENT

A. Conventional CMP Pad Dressers Circa 2007

Circa 2007, conventional diamond pad conditioners were unable to produce micron-sized asperities at high density because the tips of the diamond grits could not be leveled to the same height. (Ex. 2005 at 1:4-6.) The variation in tip height distribution was “intrinsically large (50-100 microns),” which made “the cutting depth of the pad var[y] significantly.” (*Id.* at 1:23-24.)

At this time, it was thought that controlling the tip heights of the diamond grits *during manufacturing* of the CMP pad dresser would result in none of the diamond grits being overly stressed and “all diamond grits . . . sharing the dressing work” during use. (*See* Ex. 2005 at 1:11-13.) While this assumption would later turn out to be incomplete, if not inaccurate, it was the understanding at the time of how CMP pad dressers operated in practice. (Ex. 2004 at ¶¶34-36.)

B. Sung ’479’s Understanding of CMP Pad Dressers

Reflecting that then-prevailing understanding of the ability to control the heights of the diamond grit to a certain degree and its effect, *see id.*, Sung ’479 published on April 24, 2008, but never issued as a patent. (Ex. 1005 at 1.) It addressed “issues with properly holding very small superabrasive particles” in the CMP pad dresser as well as “metal braze alloys [that] have the tendency to warp and buckle during a heating process, causing additional issues in obtaining a CMP pad

dresser having superabrasive particle tips leveled to within a narrow tolerance range.” *Id.* at [0007]; *see also* [0006] (“[T]he superabrasive particles are so small that a traditional metal matrix is often unsuitable for holding and retaining them.”; “Traditional CMP pad dressers can have particle tip height variations of more than 50 μm without compromising dressing performance.”).

To reduce “the variance between the tip heights of a plurality of superabrasive particles in a tool,” Sung ’479 discussed “utilizing a braze having a low-melting point to bond the superabrasive particles.” (Ex. 1005 at [0050]; *see also* [0051] (providing “a method for making a low-melting point superabrasive tool having a plurality of superabrasive particles”).) Sung ’479 explained that “[s]uch low-melting point braze materials do not generate significant warpage due to the lower temperatures utilized to construct the tool.” (*Id.* at [0050].)

In addition, Sung ’479 states that “leveling the tips of the plurality of superabrasive particles in the tool reduces the mechanical stress impinging on any individual superabrasive particle, thus counteracting the relatively lower retention strength of many low-melting point brazes as compared to traditional braze alloys.” (Ex. 1005 at [0050].) Further, “[b]y reducing such impinging stress, superabrasive particles can be more readily retained in the solidified braze, particularly when used for delicate tasks.” (*Id.*)

In short, Sung '479 disclosed CMP pad dressers with certain features formed in certain ways that were thought to reduce tip height variance and minimize mechanical stress on the superabrasive particles based on the assumption that the bulk of the superabrasive particles performed cutting and thus substantially equally shared substantially all of the mechanical stresses during actual use. (Ex. 2004 at ¶¶34-36, 42). It provided “[v]arious configurations or arrangements . . . for minimizing the mechanical stress impinging on the superabrasive particles held in a tool. One potentially useful parameter may include the height that the superabrasive particles protrude above the solidified braze layer.” (Ex. 1005 at [0067].)

Sung '479 expressly recognized that “there may be some height deviation between superabrasive particles that occur due to limitations inherent in the manufacturing process.” (Ex. 1005 at [0069].) Even if “it is intended that the plurality of superabrasive particles align along the designated profile, some level of deviation may occur,” in an unquantified amount. (*Id.* at [0072].)

But Sung '479 neither identified the level of height deviation that was likely to occur, nor taught anything about how any of its various disclosed dresser designs would operate in practice. (Ex. 2004 at ¶53.) It likewise did not explain how reducing particle tip height variation (or any particular range of particle tip heights)

in its invention correlated to performance in dressing CMP pads.¹ (*Id.*) It simply assumed that reducing particle tip variation would result in superior performance in operation, consistent with the prevailing thinking about how dressers actually functioned. (*See* Ex. 2004 at ¶¶34, 53.) Sung '479 never provided any description of the particular superabrasive particles that would actually cut asperities in the CMP pad during conditioning and thus experience greater mechanical forces, nor did Sung '479 teach any way that such particles would (or could) be identified. (Ex. 2004 at ¶54.)

Around the same time, Dr. Sung discovered that CMP pad dressers using an organic matrix² in a “reverse casting” process to hold pre-leveled diamond tips could

¹ Sung '479 noted only that the particle tip height variation of over 50µm in *traditional* pad dressers was unsuitable to dress a CMP pad and achieve a uniform asperity depth of less than 20µm. (*See* Ex. 1005 at [0006].)

² Dr. Sung contrasts disks made using an organic matrix versus those made using brazing throughout Ex. 2005, extolling the virtues of his organic matrix. (*See, e.g.*, Ex. 2005 at 1:25-27, 4:6-7, 6:18-19.) There is no indication in the paper that Dr. Sung was able to achieve a height variation of less than or equal to 50µm using brazing.

reduce their height variation to within 20 μ m. (*See* Ex. 2005 at 1:30-2:3.) Consistent with the prevailing (but inaccurate and incomplete) understanding of how CMP pad dressers operated at that time, Dr. Sung concluded that this level of controlling tip height variation manufacturing would result in “all diamond grits . . . sharing the dressing work” and would produce a “number of working grits . . . significantly higher than conventional designs.” (Ex. 2005 at 1:12-14, 6:20 (“ODD has much higher count of working crystals”).)

C. Subsequent Understanding of CMP Pad Dressers in Usage

But the assumption that the as-manufactured distribution of diamond grits corresponded to performance in usage conditions, when pressed against the CMP pad, turned out to be incomplete, if not inaccurate. (Ex. 2004 at ¶¶34-36, 42-47.)

Even as of 2009, it was recognized that because “the tips of diamond grits are not at the same height” and they “differ in shape and can be oriented differently,” “the dressing behaviors of polishing pads are unpredictable.” (Ex. 2006 at 3-4; *see* Ex. 2004 at ¶¶34-38; Ex. 2007 at 1 (“diamond grits have various shapes and orientations and so their dressing behaviors are unpredictable”). It was not until that time that the dressing behavior of even a single diamond was characterized under particular conditions. (*See generally* Ex. 2006; *see* Ex. 2004 at ¶38.)

Similarly, as of 2009, Sung '479's assumptions that the mechanical stress was substantially equally distributed among the bulk of the superabrasive particles remained an "inference [that] still need[s] to be experimentally verified." (Ex. 2008 at 5.) It turned out to be incorrect. (Ex. 2004 at ¶¶34-36, 40-47.)

As of 2010, most of the studies on pad dressings were experimental investigations. (*See* Ex. 2009 at 2.) Even a cutting-edge simulation module for a diamond dresser for CMP conditioning developed in 2010 still took a "bulk view" of the superabrasive particles that only considered the "the effective radius and the distributed density of the diamond grits." (*Id.*) It assumed a uniform distribution of superabrasive particles on the dresser based on a study concluding that "the patterns of diamond grits have no significant influence on the final dressing results." (*Id.* at 5.) It did not consider parameters like the orientation, protrusion depth, and height variation among the superabrasive particles. (*See id.*; Ex. 2004 at ¶¶36-37.)

Even circa 2011, what was then considered "a conventional diamond pad conditioner" still had "large variation in the height of the tips of the diamond grits on the" dresser. (Ex. 1013 at 3, 6.) But by then, it was finally beginning to be recognized that as a result of that height variation, "many diamond grits . . . did not contribute to cutting," and instead, most diamond grits in contact with the CMP pad

merely deformed the dirty pad by pushing debris around. (*See id.*; *see also* Ex. 2004 at ¶¶45-47.)

Actually controlling the height variation of the superabrasive particles to the extent that more than just a handful of them were able to cut the CMP pad during usage remained elusive and was not practically achievable. (*See* Ex. 2004 at ¶¶37-45.) Only shortly before the invention of the '270 patent was it recognized that understanding how particular CMP pad dresser designs worked in practice required post-use analysis of the dresser itself. (*See* Ex. 2010 at 1 (“Estimation of the depth-of-penetration of working diamonds, from used disk analyses, allows meaningful topographic assessments of alternative conditioner designs and predictions of relative performance.”), 3, 4 (“The fine-finish disk design improvements were validated by polishing experiments” that compared the two designs in actual usage conditions), 7 (concluding that “[p]ost-use examination of conditioners provides information regarding the depth-of-penetration (DOP) of the working diamonds into the CMP pad”); Ex. 2004 at ¶¶41-44.) In other words, the height variation of the grit as designed, or even as manufactured, did not predictably correlate with how it actually operated. (Ex. 2004 at ¶¶42-46.)

D. The Context of the '270 Patent

It was from this revised understanding of how CMP pad dressers operated in

practice that the '270 patent arose:

[T]he present disclosure concerns CMP pad dressers having superabrasive particles with substantially leveled tips. *Traditional CMP pad dresser manufacturing methods, even many of those describing techniques for leveling superabrasive particle tips prior to fixation, generally contain significant variation in tip height across the surface of the dresser.* Often, the superabrasive particles are affixed to the CMP pad dresser support in a manner that disrupts any leveling that has occurred. For example, fixation techniques that utilize high heat and/or pressure can cause warping of the dresser support as the dresser cools. Thus, unless steps are taken to avoid such warpage, superabrasive particles are not maintained in their leveled state following cooling of the dresser.

(Ex. 1001 at 6:42-53.) The '270 patent likewise reflected the updated understanding of a POSITA that only a small percentage of superabrasive particles in a typical CMP pad dresser are working particles. (Ex. 2004 at ¶55.) For example, though a CMP pad dresser may contain thousands of particles (*e.g.*, Pet. at 48), there may only be a few working superabrasive particles that are actually able to cut the CMP pad. (Ex. 2004 at ¶55.) The '270 patent indicates this to a POSITA clearly: “If the *three* highest protruding superabrasive particles on every dressing segment are leveled across the entire rigid support, a CMP pad dresser is made having very precise tip leveling across the entire surface.” (Ex. 1001 at 13:65-14:2 (emphasis added); *see also* Ex. 2004 at ¶56.) It continues, “If, for example, ten dressing segments are used to make the CMP pad dresser, then the highest protruding *thirty* superabrasive

particles in the tool will have effectively the same protrusion distance and be substantially leveled.” (*Id.* at 14:2-6 (emphasis added); *see also* Ex. 2004 at ¶56.)

It was thus the few tallest diamond grits on the diamond disk that determined the overall effectiveness of CMP pad conditioning. (*See* Ex. 2004 at ¶56.)

But rather than try to eliminate the outliers to share the workload, as prior art solutions including Sung ’479 taught, the ’270 patent focuses on bounding and characterizing the protrusion among, and variance in, the outlying superabrasive particles that actually performed the work. (*See, e.g.*, Ex. 1001 at Abstract; *see* Ex. 2004 at ¶57.)

To that end, while Sung ’479 taught that “the superabrasive particle tips may be leveled to spread the mechanical forces impinging on the tool across ***substantially all of the particles***” ([0067]) (emphasis added), the ’270 patent focuses only on the working particles. (Ex. 2004 at ¶58.) One disclosed (and claimed) embodiment involves a 50µm ***maximum*** height variation between working particles: the highest and second-highest protruding tips differing by ~50µm (or less). (Ex. 1001 at 17:38-18:2.) This reflects (and results from) the revised understanding that the performance of a CMP dresser is determined primarily by the outliers in protrusion, and not by the evenness of the bulk material. (*See* Ex. 2004 at ¶¶34-36, 44-46, 58.)

In other words, the inventions recited in the '270 patent were provided in the context of a POSITA's updated understanding that the manufacturing profile of the diamond tips of a pad dresser did not readily correlate with its performance in actual usage, and that in fact, the overwhelming majority of superabrasive particles did no work at all in dressing the CMP pad. (*See* Ex. 2004 at ¶¶44-46, 55-58.) The assumptions underlying Sung '479—that relatively low height deviations among the diamond tips in manufacturing would result in shared work across the overwhelming majority of the diamond grit because the bulk of the diamond grits were involved in pad dressing—would not have been applied by a POSITA in contravention of what the subsequent development of the art as reflected in the '270 patent expressly taught to the contrary. (*See* Ex. 2004 at ¶¶34-36, 45-47, 57-59.)

VII. RESPONSE TO PETITIONERS' SPECIFIC GROUNDS FOR CHALLENGE

A. Ground 1: The Combination of Chou and Sung '479 Does Not Render Obvious Claims 1 and 3-8

Regarding claim 1, Petitioners have failed to establish by a preponderance of evidence that the combination of Chou and Sung '479 renders obvious claim 1 by expressly or inherently disclosing the elements of claim 1.

1. Patent Owner's Arguments Involving a Different Patent in a Different Proceeding Do Not Create Collateral Estoppel Here

Petitioners claim that PO “is collaterally estopped from re-litigating the issue of whether the Chou reference discloses at least [1Pre] and [1D] of the ’270 Patent” due to a previous IPR against PO attacking an entirely different patent, U.S. Patent No. 8,777,699 (the “’699 patent”). (Pet. at 57.) Petitioners are incorrect.

In IPR2014-01523, the Board issued a Final Written Decision (“’699 Kinik IPR”) invalidating the ’699 patent. *See Kinik Co. v. Chien-Min Sung*, IPR2014-01523, Paper 26 (Nov. 4, 2015). Based on PO’s arguments concerning *the ’699 patent* in the ’699 Kinik IPR, Petitioners seek to apply a collateral estoppel to prevent PO from arguing that the Chou reference is inapplicable against various limitations of the claims *of the ’270 patent* here. But this is not how collateral estoppel operates with respect to different patents, and the Board should reject Petitioners’ invitation to ignore clear Federal Circuit precedent.

Although “patent claims need not be identical,” collateral estoppel always “requires that the issues of patentability be identical.” *Google LLC v. Hammond Dev. Int’l, Inc.*, 54 F.4th 1377, 1381 (Fed. Cir. 2022) (citing *Soverain Software v. Victoria's Secret Direct Brand Management, LLC*, 778 F.3d 1311, 1319 (Fed. Cir. 2015) and *Ohio Willow Wood v. Alps S., LLC*, 735 F.3d 1333, 1342 (Fed. Cir. 2013)). “Thus, collateral estoppel may apply even if the patent claims ‘use slightly different language to describe substantially the same invention,’ so long as ‘the differences

between the unadjudicated patent claims and adjudicated patent claims do not materially alter the question of invalidity.” *Id.* (citing *Ohio Willow Wood* at 1342).

“Whether the differences between the patent claims materially alter the question of patentability is a legal conclusion based on underlying facts.” *Id.*

Here, the differences between the unadjudicated patent claims of the ’270 patent and the adjudicated patent claims of the ’699 patent **do** materially alter the question of invalidity and the issues of patentability are **not** identical.

As an initial matter, the ’699 patent claims do not contain element “[1B]” of the ’270 patent, or any equivalent thereto. As identified by Petitioners, element [1B] recites “wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns.” Petitioners **admit** that element [1B] is not recited in the ’699 patent. (Pet. at 28n.7.)

Moreover, Petitioners **admit** that Chou **does not** teach claim element [1B] of claim 1 of the ’270 patent. (Pet. at 30.) This concession is fatal to Petitioners’ collateral estoppel argument. At least the addition of this claim element beyond what was argued in the ’699 Kinik IPR “materially alter[s] the question of invalidity” such that additional analysis and prior art references are required here. Thus collateral estoppel does not apply. *Id.*

In the '699 Kinik IPR, only Chou was needed for invalidity; claim 1 of the '699 patent was deemed anticipated by Chou. *Kinik*, IPR2014-01523, Paper 26 at 23. But, as set forth below, Petitioners' invalidity arguments here required adding Sung '479, which was not even considered in the '699 Kinik IPR. Thus, the "issues of patentability" here are not identical, and collateral estoppel does not apply.

2. Sung '479 Is Not Enabling to Teach "the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns"

Petitioners have relied on only Sung '479 and Chou to allege obviousness of claim 1 of the '270 patent. Petitioners admit that Chou does not teach the claim element, "the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns," relying exclusively on Sung '479. Because "a standalone § 103 reference must enable the portions of its disclosure being relied upon," Sung '479 "***must necessarily enable*** the relied-upon portion of its own disclosure." *Raytheon Techs. Corp.*, 993 F.3d at 1381 (emphasis added). It fails.

To be enabling, a POSITA must be able to "make or use" the invention of the reference without "undue experimentation." *In re Morsa*, 713 F.3d 104, 110

(Fed. Cir. 2013). “The determination of what level of experimentation is ‘undue’” is “made from the viewpoint of persons experienced in the field of the invention,” and “requires the application of a standard of reasonableness, having due regard for the nature of the invention and the state of the art.” *Elan Pharms., Inc. v. Mayo Found. for Med. Educ. & Research*, 346 F.3d 1051, 1055 (Fed. Cir. 2003) (internal citations omitted).

Here, a POSITA could not have combined Sung ’479’s disclosure with his own knowledge to make the claimed invention of the ’270 patent without undue experimentation. (Ex. 2004 at ¶61.)

As an initial matter, Sung ’479 is not an enabling reference for claim 1 here because it describes operation in different and non-overlapping brazing conditions than those of the ’270 patent. (Ex. 2004 at ¶62.) Sung ’479 is expressly limited to brazes having melting point temperatures of under 700 degrees (*e.g.*, Ex. 1005 at Abstract, [0009], [0013], [0051], [0061], [0063], claim 1), while the ’270 patent uses brazes having melting point temperatures of 700-1200 degrees (*e.g.*, Ex. 1001 at 11:64-12:2). (*Id.*) A POSITA would not have been able to apply the low-temperature teachings of Sung’479 to the higher-temperature brazes of the ’270 patent without undue experimentation. (*Id.*)

Even putting aside that Sung '479 addresses different operating conditions, the disclosure of Sung '479 lacks crucial details for implementing the described “leveling process” to align particle tips along the designated profile that Petitioners claim obviates claim 1 of the '270 patent. (Ex. 2004 at ¶63.) For example, Sung '479 provides no description for the composition or properties of the “leveling surface” used to level the particle tips such that it allows for the plurality of superabrasive particles to have RA values of “less than about 40 μm ,” “less than about 30 μm ,” “less than about 20 μm ,” or “less than about 10 μm .” (Ex. 1005 at [0067]; Ex. 2004 at ¶63.) Sung '479 discloses these different RA values are possible but does not indicate *how* to achieve these differing results using the ambiguous “leveling surface” or *why* the results would differ using this “leveling surface.” (Ex. 2004 at ¶63.) A POSITA would not have known how to achieve these various results without extensive trial-and-error experimentation. (*Id.*)

Sung '479 further fails to instruct a POSITA how to achieve alignment along a so-called “designated profile.” (Ex. 2004 at ¶64.) Sung '479 merely states that “[i]t may also be beneficial for the superabrasive particles to protrude from the solidified braze layer to a predetermined height or series of heights that is/are along a designated profile.” (Ex. 1005 at [0069]; Ex. 2004 at ¶64.) But no direction is given as to how to align the particles in such a way on a plane, let alone in

“multiple slopes” or a “curved shape.” (Ex. 1005 at [0070]-[0071]; Ex. 2004 at ¶64.) At best, Sung ’479 states that “the superabrasive particles may be arranged along a leveling surface that has a shape corresponding to a particular designated profile.” (Ex. 1005 at [0071]; Ex. 2004 at ¶64.) But again, it provides no direction as to what constitutes such a “leveling surface” or *how* such a “leveling surface” could be used to, or would be able to, create a brazed diamond disk (“BDD”) CMP pad dresser with superabrasive particles “arranged such that their tips vary from the designated profile by less than about 1 microns.” (Ex. 1005 at [0072]; Ex. 2004 at ¶64.) As Dr. Tsai has explained, a POSITA would not have been able to arrange particles in such a way without undue experimentation. (Ex. 2004 at ¶¶32, 64.) In fact, Dr. Tsai opines that at the time Sung ’479 was filed, it was not practically achievable to consistently and predictably manufacture a BDD CMP pad dresser having superabrasive particle tip height variation *less than 50 microns*, let alone 2 microns. (Ex. 2004 at ¶32.)

With regard to constructing its tool, Sung ’479 similarly fails to instruct a POSITA how to remove the “spacer layer” and “temporary spacer layer” from the low-melting point braze matrix to expose the superabrasive particles without damaging, removing, or otherwise shifting the particles from the braze matrix. (See Ex. 1005 at [0085]-[0086]; Ex. 2004 at ¶65.) (And it provides even less

guidance for the higher-temperature braze matrices described and claimed in the '270 patent.) (Ex. 2004 at ¶65.) Sung '479 merely states that the spacer layers can be removed by “peeling, grinding, sandblasting, scraping, rubbing, abrasion, etc.,” and that even after these caustic actions, “[t]he braze material may be etched, sandblasted or abraded to further expose the superabrasive particles.” (Ex. 1005 at [0086]; Ex. 2004 at ¶65.) But nowhere does Sung '479 indicate how such actions allow the particles to achieve or retain any alignment or leveling. (Ex. 2004 at ¶65.) A POSITA would have been required to perform undue experimentation to perform these layer-removal steps and retain particle alignment. (*Id.*)

Sung '479 also fails to instruct a POSITA how to level particles on a double-sided CMP pad dresser, such as that of claim 1 of the '270 patent. It merely includes a single sentence stating that “superabrasive particles 14 may be disposed . . . along multiple surfaces as shown in FIG. 6.” (Ex. 1005 at [0054].) Figure 6 is shown below:

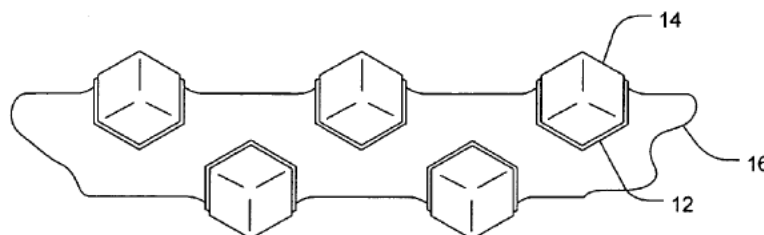


FIG. 6

(Ex. 1005, Fig. 6.) No support or other attachment is shown or described to explain how such a structure would be, or could be, used in practice. (Ex. 2004 at ¶66.) Further, again, no description is given as to *how* particles on such a two-sided structure would be leveled or *the extent to which* those particles even could be leveled. (*Id.*) There is absolutely no discussion how to achieve “the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns” in a two-sided CMP pad dresser. (*Id.*) Sung ’479 doesn’t even provide height ranges associated with Figure 6. A POSITA would not have been able to create a working structure in this form without undue experimentation, let alone such a structure with level particles. (*Id.*) Petitioners and/or their expert do not suggest otherwise either. (*Id.*)

In addition, Sung ’479 lacks any disclosure of working examples or prototypes to validate its leveling processes. (Ex. 2004 at ¶67.) A POSITA could not have readily replicated the disclosed methods. (*Id.*)

For all of the above reasons, Sung ’479 does not include an enabling disclosure of “the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns” in a CMP pad dresser, much

less in a two-sided CMP pad dresser, as set forth in claim 1. (Ex. 2004 at ¶68.)

Because the Petitioner relies solely on Sung '479 for this limitation, Petitioner has not shown by a preponderance of evidence that the proposed combination of Chou and Sung '479 would have rendered claim 1 obvious at the time of the invention.

3. Chou and Sung '479 Do Not Disclose “a first monolayer of superabrasive particles . . . , wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns”

Claim 1 recites a CMP pad dresser comprising, *inter alia*, the following elements:

a first monolayer of superabrasive particles disposed on and protruding from one side of a metal support layer, *wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns;*

(Ex. 1001 at 17:35-18:2) (emphasis added). The Petition states that “Chou teaches that *all* of the first monolayer of particles 232 are designed to participate in the grinding action, which a POSITA would have recognized to be achievable by reducing the protrusion distance differences between the particles.” (Pet. at 28) (original emphasis). But Chou is subject to the same incorrect assumptions underlying CMP pad dressing that Sung '479 is, and a POSITA would not have applied such aspects of Chou by the time of the '270 patent. (Ex. 2004 at ¶69.)

Petitioners provide no evidence that “participat[ion] in the grinding action” requires that—nor that any such “reducing” would be performed such that—“the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns,” as required by the claim language. Further, Chou does not explain how reducing particle tip height variation (or any particular range of particle tip heights) in its apparatus correlates to performance in dressing CMP pads. (Ex. 2004 at ¶70.) It simply assumes that reducing particle tip variation post-manufacturing would result in superior performance in operation, consistent with the then-prevailing thinking—now recognized to be incorrect—about how dressers actually functioned. (Ex. 2004 at ¶¶34-36, 69-70.)

The Petition relies on an annotated version of Fig. 5D of Chou (reproduced below) to support its argument that Chou teaches all particles being the same height. However, when a reference does not disclose that its drawings are to scale and is silent as to dimensions, arguments based on measurement of the drawing features are of little value. *See Hockerson-Halberstadt, Inc. v. Avia Group Int’l*, 222 F.3d 951, 956 (Fed. Cir. 2000) (“[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.”). Chou makes no mention

of its drawing being to scale. Nor does Chou describe the protrusion distances of its particles. (Ex. 2004 at ¶70.) Therefore, Petitioners cannot rely on Chou's figures to obviate the numerical bounds of the claim language.

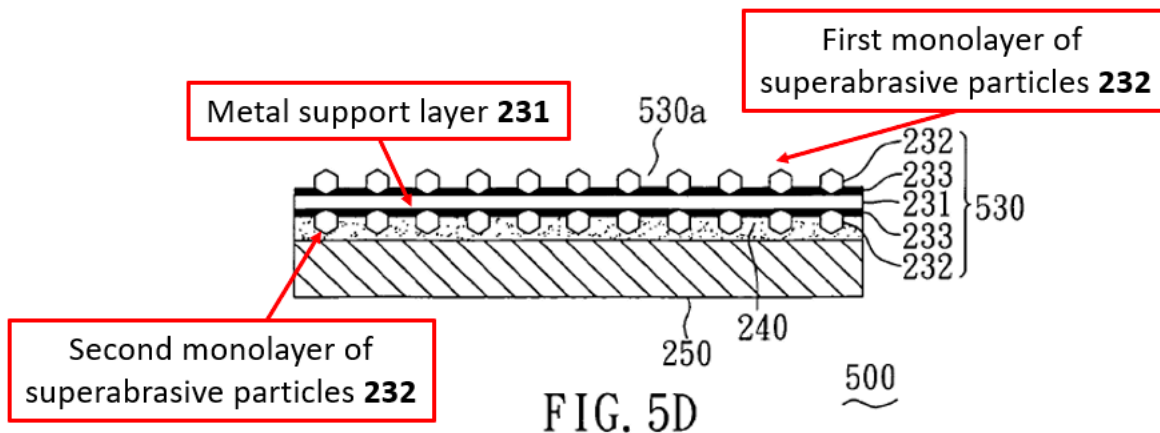


FIG. 5D of Chou (Ex. 1004) (Annotated by Petitioner)

Petitioners, recognizing Chou's shortcomings, admit that Chou "does not explicitly teach" this claim element. (Pet. at 28-29.) Instead, Petitioners look to Sung '479, alleging it "teaches tip height variations of only 2 microns or less across all superabrasive particles." (Pet. at 29.) For support, Petitioners cite that, in Sung '479, "the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by less than about 1 microns." (Pet. at 30-31.) But as discussed above, Sung '479 does not describe how any such arrangement is possible. (Ex. 2004 at ¶¶32, 63-64.) Indeed, methods for consistently achieving the miniscule tip variation of "less than about 1 microns" as a general matter in BDD CMP pad

dressers were not known at the time Sung '479 was published. (Ex. 2004 at ¶32; *see also* Section VII.A.2.)

There is no disclosure of this claim element.

4. There Is No Motivation to Combine Chou and Sung '479 to Obviate “a first monolayer of superabrasive particles . . . , wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns”

Even if all of the claim elements were in the cited art (which Petitioners have not carried their burden to show), Petitioners have not met their burden to show why and how a POSITA would have combined Chou with Sung '479 in the particular way necessary to allegedly make obvious “a first monolayer of superabrasive particles . . . , wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 50 microns,” as recited in claim 1. *Unigene Labs.*, 655 F.3d at 1360; *In re Kahn*, 441 F.3d 977, 988.

Petitioners state that it would have been obvious to a POSITA to have “precisely leveled protrusion distances,” and that a POSITA “would have been able to achieve such precisely leveled CMP pad dressers.” (Pet. at 32-34.) As Dr. Tsai has explained, Petitioners are incorrect. (Ex. 2004 at ¶¶32, 36-38, 44-46.) And Dr. Shanfield’s conclusory assertions to the contrary (*e.g.*, Ex. 1002 at ¶115) is simply

not credible given his lack of expertise in the precise technology at issue here. (*See* Section III; *see also* Ex. 2004 at ¶¶25-29.)

And Petitioners fail to explain how such “level[ing]” would have been achieved or even if the claimed “difference in protrusion distance” being “less than or equal to about 50 microns” would have been considered “level.” Regardless, Petitioners set forth supposed reasons to combine Chou and Sung ’479. (Pet. at 34-39.) None of these suffice to carry Petitioners’ burden here.

Petitioners argue that Chou and Sung ’479 “disclose that the abrasive tools perform better if the abrasive particles are leveled,” so a POSITA would combine references “that recognize benefits of having leveled height of abrasive particles.” (Pet. at 34-36.) Dr. Tsai explained that this is incorrect. (Ex. 2004 at ¶¶34-38, 40-46.) Petitioners’ supposed motivation also falls flat.

Petitioners argue that a POSITA would have been motivated to combine Chou and Sung ’479 because both use brazes, with Sung ’479 utilizing a low-melting point braze to bond particles because such brazes “do not generate significant warpage due to the lower temperatures utilize (sic) to construct the tool” and “the variance between the tip heights of a plurality of superabrasive particles in a tool can be greatly reduce by utilizing a braze having a low-melting point to bond the superabrasive particles.” (Pet. at 36.) But Chou purports to solve these problems by

itself, which obviates the need to add Sung '479. (*See, e.g.*, Ex. 1004 at [0024] (“[T]he method provided by the present invention can inhibit the precision errors caused by the thermal deformation of the backplane.” And, “[b]y the method for fabricating a grinding tool according to the present invention, the height of the abrasive particles can be precisely controlled.”).) Petitioners fail to explain why a POSITA would have looked to the teachings of Sung '479 to solve problems that Chou claimed to have already solved. Additionally, as described above in Section VII.A.2, Sung '479 is expressly limited to brazes having melting point temperatures of *under* 700 degrees, while the '270 patent uses brazes having melting point temperatures of 700-1200 degrees. (*See* Ex. 2004 at ¶62.) Sung '479 is not enabling for—and indeed, teaches away from—the higher temperatures associated with the brazes of the '270 patent, and a POSITA would not have looked to Sung '479 to level particles at a higher temperature. (*See id.*)

Petitioners state that Chou and Sung '479 “teach attaching a monolayer of diamond particles to both sides of the substrate.” (Pet. at 36-38.) Petitioners provide no reasoning as to why a POSITA would have combined references simply because they may share certain characteristics. Worse, Sung '479’s description of multiple surfaces is devoid of explanation beyond the image of Figure 6, as described above in Section VII.A.2. (*See* Ex. 2004 at ¶66.) Petitioners’ alleged motivation to

combine is lacking.

Petitioners assert that “it would have been a trivial modification by POSITA to level the heights of the Chou’s abrasive tool to the precision as disclosed by Sung ’479” because “Sung ’479 provides specific numeric values that were well-known to be achievable and suitable for various grinding application, such as CMP.” (Pet. at 38.) But as Dr. Tsai has explained, this is incorrect. (*See* Ex. 2004 at ¶¶32, 63-64.) Sung ’479’s numeric values were not achievable (Ex. 2004 at ¶32), and Petitioners do not explain why any such purportedly “trivial modification” would have given a POSITA motivation to combine those two references *in that particular fashion*. (Ex. 2004 at ¶¶71-72.) Petitioners and Dr. Shanfield are using impermissible hindsight in their analysis. (*Id.*) Petitioners’ arguments are insufficient.

Petitioners further contend that a POSITA “would have been able to combine” the teachings of Chou and Sung ’479 with a reasonable expectation of success because “both use the similar brazing method for attaching abrasive particles to the metal substrate.” (Pet. at 38-39.) However, the brazing methods in the two-sided embodiments of Chou and Sung ’479 are not similar. Chou shows particles 232 in separate braze layers 233 on opposite sides of a substrate 231 (*e.g.*, Chou at [0039]), whereas Sung ’479 at best shows particles 14 on opposite sides of a single braze 16

(Sung '479 at Fig. 6). Petitioners have not explained how these very two different brazing methods demonstrate that a POSITA would be able to combine their teachings with a reasonable expectation of success. (*See, e.g.*, Ex. 2004 at ¶62.) Further, as described above, the brazing of Sung '479 is completely different from that of the '270 patent, and a POSITA wouldn't be able to apply Sung '479's brazing to the '270 patent. (*See* Section VII.A.2; Ex. 2004 at ¶62.)

Moreover, Petitioners give no indication how a POSITA would have combined the “designated profile” aspects of Sung '479 with Chou's two-sided grinding tool or why the results of the combination would be predictable. Again, this is impermissible hindsight. (Ex. 2004 at ¶¶71-72.) For example, Petitioners fail to address whether protrusion distances of particles would be the same or different on opposite sides of the CMP pad dresser and/or how similarities or differences in such protrusion distances on opposite sides of a CMP pad dresser might affect warpage. Petitioners' argument is therefore lacking.

Petitioners have failed to evidence a motivation to combine Chou and Sung '479 to obviate the language recited in claim 1.

5. Dependent Claims 3-8

Claims 3-8 depend from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claims 3-8 are

not obvious over Chou in view of Sung '479 for at least all of the reasons discussed above with regard to claim 1.

B. Ground 2: Chou in view of Sung '479 and SungECS Does Not Render Obvious Claims 6 and 7

1. Claim 6

Claim 6 depends from claim 5, which depends from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 6 distinguishes over Chou in view of Sung '479 for at least all of the reasons discussed above with regard to claim 1 in Section VII.A. SungECS is relied on by Petitioner to allegedly show that a CMP pad dresser has “tens of thousands of diamond particles.” (Pet. at 50-52.) Petitioner’s conclusory statements that it would have been obvious that protruding tips of “tens of thousands of diamond particles,” as allegedly shown in SungECS, would fall within a designated profile does not remedy the deficiencies of Chou and Sung '479 with respect to claim 1 discussed above in Section VII.A. (Pet. at 50-52.)

2. Claim 7

Claim 7 depends from claim 6 (and, in turn, from claims 5 and then 1). A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 7 is not obvious over Chou in view of Sung '479 for at least all of the reasons discussed above with regard to claim 1 in Section VII.A.

Petitioner relies upon SungECS to allegedly show that a CMP pad dresser has “tens of thousands of diamond particles.” (Pet. at 50-52.) Petitioner’s conclusory statements that it would have been obvious that protruding tips of “tens of thousands of diamond particles,” as allegedly shown in SungECS, would fall within a designated profile does not remedy the deficiencies of Chou and Sung ’479 with respect to claim 1 discussed above in Section VII.A. (Pet. at 50-52.)

C. Ground 3: Chou in view of Sung ’479 and Goers Does Not Render Obvious Claim 2

1. Claim 2

Claim 2 depends from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 2 is not obvious over Chou in view of Sung ’479 for at least all of the reasons discussed above with regard to claim 1 in Section VII.A. Petitioners rely upon Goers to allegedly show that CMP pad dressers were known to have central, particle-free areas. (Pet. at 53-54.) Petitioner’s conclusory statements that it would have been obvious to combine Goers with Chou and Sung ’479 to create a CMP pad dresser with a central, particle-free zone does not remedy the deficiencies of Chou and Sung ’479 with respect to claim 1 discussed above in Section VII.A.

VIII. CONCLUSION

For at least the foregoing reasons, Petitioners have failed to meet its burden to show that the claims are invalid by a preponderance of the evidence. Therefore, the Petition should be denied.

Case IPR2024-00533
Patent No. 8,974,270
Patent Owner Response

Dated: January 6, 2024

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Case IPR2024-00533
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Patent Owner Response

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Patent Owner Response consists of 7,789 words, excluding cover page, table of contents, table of authorities, certificate of service, this certificate, or table of exhibits. The POR complies with the type-volume limitation of 14,000 words as mandated in 37 C.F.R. §42.24. In preparing this certificate, counsel has relied on the word count of the word-processing system used to prepare the paper (Microsoft Word).

Dated: January 6, 2025

Respectfully submitted,

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Case IPR2024-00533
Patent No. 8,974,270
Patent Owner Response

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on January 6, 2025, the foregoing document and accompanying exhibits are being served via electronic mail upon the following counsel of record for Petitioner:

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