

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

IPR2024-00535
U.S. Patent No. 9,724,802

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

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TABLE OF EXHIBITS

Exhibit	Description
2001	U.S. Patent Application No. 11/560,817 (“Sung ’817”)
2002	U.S. Provisional Application No. 61/489,074
2003	<i>Kinik Co. v. Chien-Min Sung</i> , IPR2021-00638, Patent Owner’s Preliminary Response (June 10, 2021)
2004	Volume 2 of Deposition Transcript of Stanley Shanfield in <i>Chien-Min Sung v. Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC</i> (E.D. Tex.), held on May 28, 2024.
2005	Data on EDTX Motions to Stay Pending Inter Partes Review compiled by www.docketnavigator.com
2006	Plaintiff Dr. Chien Min-Sung’s Preliminary Disclosure of Asserted Claims and Infringement Contentions from <i>Chien-Min Sung v. Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC</i> (E.D. Tex.).
2007	Defendants’ P.R. 3-3 Invalidity Contentions from <i>Chien-Min Sung v. Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC</i> (E.D. Tex.).
2008	Declaration of Stanley Shanfield, Ph.D. in Support Of Defendants’ Proposed Claim Constructions from <i>Chien-Min Sung v. Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC</i> (E.D. Tex.).
2009	U.S. Application No. 11/223,786 (“Sung ’786”)
2010	M.Y. Tsai and Y.S. Liao, <u>Dressing Characteristics of Oriented Single Diamond on CMP Polyurethane Pad</u> , <i>Machining Science and Technology</i> , 13:92-105 (2009).
2011	Declaration of Ming-Yi Tsai
2012	IPR2024-0534, Petition for <i>Inter Partes</i> Review of U.S. Patent No. 9,138,862

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Pursuant to 37 C.F.R. § 42.120, Patent Owner Chien-Min Sung (“Patent Owner” 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. 9,724,802 (the “’802 Patent”) are anticipated or rendered obvious. Yet, all three of their asserted grounds of unpatentability turn entirely on an argument for a later priority date for the claims of the ’802 Patent that is both legally incorrect and misconstrues the file history of the ’802 Patent.

Consequently, each of Petitioners’ asserted grounds depend on references that are not prior art to the ’802 Patent. Tsai (Ex. 1004), the sole reference for Ground 1, was published *after* the three priority dates to which the ’802 Patent is entitled. As to Sung ’026 (Ex. 1005) and Sung ’146 (Ex. 1029), they are both *grandparents* of the ’802 Patent and to which the ’802 Patent claims priority. As such, neither Sung ’026 nor Sung ’146 is prior art to the ’802 Patent.

Tsai also does not anticipate the challenged claims of the ’802 Patent because Tsai fails to teach or suggest the “designated profile,” “tip variation” from a designated profile, “highest protruding tip,” “second highest protruding

tip,” “highest 1% of the producing tips,” and the claimed difference in protrusion distance as recited in claim 1. Tsai also does not anticipate dependent claims 2-5, based on its failure to teach or disclose a “second highest protruding tip” (claims 2 and 3), “10th highest protruding tip” (claim 4), or “100th highest protruding tip” (claim 5), or claims 20 and 21, which recite “a predetermined pattern.”

For Ground 2, Tsai also fails to teach or disclose elements of the dependent claims, including claims 8-12, which recite new subject matter unique to the '802 Patent, including the claimed numbers of “working superabrasive particles.”

Petitioners' Ground 3 also fails as a matter of law because, as discussed above, neither Sung '026 nor Sung '146 is prior art. Because the '802 Patent properly claims priority to Sung '026 **and** Sung '146, neither qualifies as prior art.

In sum, Petitioners have failed to show the unpatentability to any of the claims challenged in the Petition by a preponderance of the evidence and each of the three grounds in the Petition should be rejected in their entirety.

II. BACKGROUND

A. The '802 Patent

The '802 Patented invention relates to a pad dresser for Chemical Mechanical Polishing (CMP), which is a “technique[] to manufacture smooth and even-surfaced

silicon wafers” (Ex. 1001 at 1:45-46) used in the semiconductor industry (*id.* at 1:42). CMP is performed using a polishing pad with an abrasive slurry. (*Id.* at 1:48-49.) In turn, “[a] CMP pad dresser can be used to dress or condition a CMP pad by removing dirt and debris (i.e., deglazing the pad), as well as opening up asperities in the pad surface to capture and hold chemical slurry during a polishing procedure.” (*Id.* at 9:50-54.) Each pad conditioner can have more than 10,000 superabrasive particles (*id.* at 10:44) which dress the CMP pad (*id.* at 10:5-8).

Traditional CMP pad conditioners came with drawbacks due to inherent design flaws and manufacturing limitations, including that they “generally contain significant variation in tip height across the surface of the dresser” (*Id.* at 9:38-40.) Consequently, “only a small percentage of superabrasive particles in a typical CMP pad dresser are positioned so as to penetrate or cut into a CMP pad” (*id.* at 9:56-58), and “[a]s this small percentage of superabrasive particles become worn, plastic deformation of the CMP pad becomes large relative to the amount of CMP of pad that is cut” (*id.* at 9:58-61), leaving the pad “deformed and accumulated with dirt” (*id.* at 9:62). This brings further negative effects to the CMP process, as “the polishing rate of the CMP pad declines, and the scratch rate of the wafer or work piece increases.” (*Id.* at 9:63-64.)

To that end, the ’802 Patent provides a structural solution such that the leveling of the tips of the superabrasive particles “allows differing amounts of

superabrasive particles to actually cut asperities into the pad” (*id.* at 16:8-10) and that “the relative leveling of the monolayer of superabrasive particles can greatly affect the morphology and distribution of asperities cut into the CMP pad by the dresser (*id.* at 15:30-33). Specifically, the ’802 Patent teaches that “the present CMP pad dressers can have superabrasive particles that are aligned across a designated profile, and as such, are ‘leveled’ with respect to that profile.” (*Id.* at 9:33-35.) The ’802 Patent teaches that “[n]umerous configurations for designated profiles are possible depending on the particular use of the abrading tool” (*id.* at 17:5-6), and that specific profile shapes have certain benefits for the CMP process. For example, “CMP pad dressers may include such curved profiles in order to more effectively distribute the frictional forces between all of the superabrasive particles, thus reducing failures of individual particles and prolonging the life of the dresser.” (*Id.* at 17:41-45.)

B. Tsai

Tsai, which was co-authored by Patent Owner Dr. Sung, discloses an improved Organic Diamond Disk, which is compared with a conventional Brazed Diamond Disk. (Ex. 1004 at Abstract.) Tsai’s ODD is manufactured via reverse casting of polymers, in which “the substrate is prepared after the diamond grits are leveled on the surface of a mold.” (*Id.* at 3:12-4:1.)

C. Sung ’026

Sung '026 refers to U.S. Patent Application No. 11/223,786, which was filed on September 9, 2005, and is identified in the Related U.S. Application Data section on the face of the '802 Patent. The '802 Patent is a CIP of U.S. Patent Application No. 13/797,704, which is a CIP of U.S. Patent Application No. 12/726,786, which is a CIP of U.S. Patent Application 11/560,817, which is a CIP of Sung '026.

D. Sung '146

Sung '146 refers to U.S. Patent Application No. 13/479,148, which was filed on May 23, 2012 and issued as USP No. 8,974,270 to which the '802 Patent claims priority. The '802 Patent is a CIP of U.S. Patent Application No. 13/802,112, issued as USP No. 9,138,862 (which is a CIP of Sung '146).

E. Person of Ordinary Skill in the Art (“POSITA”)

Patent Owner contends that a POSITA for purposes of the '802 patent would have at least two years of experience in developing CMP technology including experience with the design and development of CMP pad dressers. (Ex. 2011 at ¶¶ 21.) Patent Owner contends that Dr. Shanfield is not qualified as a POSITA because he lacks such experience. (See Ex. 1002 at Appendix A.) At best Dr. Shanfield states that he has worked with CMP systems (*id.* at ¶¶ 3-5), but he does not profess any experience related to the design and development of pad dressers.

F. Claim Construction

Patent Owner does not contend that any construction of any of the claim

terms of the '802 Patent is necessary because the '802 Patent expressly defines those terms at issue, such as “conditioner,” “working superabrasive particles,” “cutting depth” and “profile.”

III. THE PRIORITY DATE OF THE '802 PATENT

Petitioners' contention that the priority date for **all** of the claims of the '802 Patent is October 3, 2014 is based on a factually and legally incorrect interpretation of the intrinsic record of the '802 Patent and misconstrues Dr. Sung's Declaration in the Kinik litigation (Ex. 1011).

The '802 Patent was issued as a CIP from a number of prior applications by Dr. Sung. A CIP, by definition, contains **both** new subject matter as well as subject matter from prior applications to which the CIP (here, the '802 Patent) claims priority. See 37 C.F.R. 1.53(b)(1); M.P.E.P. § 201.08.

Consistent with these principles, “[d]ifferent claims of [a CIP] application may . . . **receive different effective filing dates.**” *Augustine Medical, Inc. v. Gaymar Industries, Inc.*, 181 F.3d 1291, 1302 (Fed. Cir. 1999). Accordingly, there need not be a single priority date for **all** challenged claims of the '802 Patent particularly if they recite both new subject matter and matter from earlier applications. Nor could the priority date **for all claims** be limited to the filing date of U.S. Patent Application No. 14/506,476 which led to the '802 Patent. That is

because, **by definition**, a CIP such as the '802 Patent must “repeat[] a substantial portion or all of the prior-filed application.” M.P.E.P. § 201.08.

Petitioners do not dispute that at least three key limitations of the sole independent claim 1 of the '802 Patent contain **only** subject matter from prior applications. (Pet. at 20-21.) Petitioners further acknowledge that during prosecution, the Applicant amended claim 1 to include the limitation “wherein a tip of each of the plurality of superabrasive particles aligns along a designated profile with a tip variation of from about 5 microns to about 100 microns,” and argued that **“this claim limitation is fully supported in the '817 application** [U.S. Patent Application No. 11/560,817], **from which the current application claims priority.”** (Pet. at 14.)¹ Moreover, Petitioners acknowledge that all of the limitations of claim 1 are disclosed in Dr. Sung’s prior applications, further reinforcing that claim 1 of the '802 Patent does not contain new subject matter. (Pet. at 20-21.)

The same is true for dependent claims 2-7 and 13-21—their subject matter is similarly disclosed in Dr. Sung’s prior applications, as will be discussed in greater detail below. Petitioners’ attempt to assert a single priority date for all of the

¹ Application claim 11 was allowed as claim 1 after claims 1-10 were rejected by the Examiner. (Ex. 1003 at 205-7.) Unless otherwise indicated, all emphasis in this Patent Owner’s Response has been added.

claims runs roughshod over the intrinsic disclosures of the claimed elements in Dr. Sung's priority applications. Each and every element of claims 2-5 and 13-21 are **fully** disclosed in both U.S. Patent Application No. 11/223,786 filed on Sept. 9, 2005 (Ex. 2009, "Sung '786") and published as U.S. Pub. No. 2007/0060026 (Ex. 1005, "Sung '026") and U.S. Patent Application No. 11/560,817 filed on November 16, 2006 (Ex. 2001, "Sung '817") and published as U.S. Pub. No. 2007/0155298 ("298 Pub"), which is a CIP of Sung '026 and issued as U.S. Patent No. 7,762,872. Both Sung '026 and Sung '817 therefore "reasonably convey[] to an artisan that the inventor had possession at that time of the later claimed subject matter." *Augustine Med.*, 181 F.3d at 1302.

A. Claim 1 Has Written Support from Sung '026, Sung '817 and Sung '074 and Is Thus Entitled to a Priority Date of Sept. 9, 2005, Nov. 16, 2006 and May 23, 2011, Respectively

Independent claim 1 of the '802 Patent is fully supported by Sung '026 and Sung '817, as reflected in the chart below. Accordingly, claim 1 is entitled to a priority date of no later than Sept. 9, 2005 based on Sung '786 or Nov. 16, 2005 based on Sung '817. Where necessary, claim 1 is also described in U.S. Provisional Application No. 61/489,074 (Ex. 2002, "Sung '074") filed on May 23, 2011 and to which the '802 Patent also claims priority. Thus, Claim 1 is also entitled to a priority date of no later than May 23, 2011 based on Sung '074.

'802 Patent, Claim 1	US Patent Application 11/223,786 published as U.S. 2007/0060026 (filed Sep. 9, 2005)²	US Patent Application 11/560,817 (CIP of '786) published as US 2007/0155298 (filed on Nov. 16, 2006) U.S. Provisional Application No. 61/489,074 (filed on May 23, 2011)
[1Pre] 1. A CMP pad dresser, comprising	Sung '786 at 2:31- , 19:24-25.	Sung '817 at 9:10-15, 1:14-15.
[1A] A rigid support substrate; and	Sung '786 at 20:11-12, 27:14-15, 28:8-9.	Sung '817 at 3:19-24 <i>See also</i> Figs. 1B, 2B, and 3B of Sung '817. Sung '074 at 1:21
[1B] a monolayer of a plurality of superabrasive particles coupled to the support substrate,	Sung '786 at 19:25-25, 28:8-9. <i>See also id.</i> at Claims 1: 30.	Sung '817 at 23:15-17, 14:15-20, 21:1-9. <i>See also id.</i> at Figs. 1B, 2B, and 3B. Sung '074 at 1:17-21.
[1C] wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance,	<i>See</i> Limitation [1B]. <i>See also</i> Sung '786 at 19:10-12, 20:12-15.	Sung '817 at 12:19-20; 13:5-7, 15:7-10. <i>See also id.</i> at Figs. 1B, 2B, and 3B. Sung '074 at 1:17-21.

² Citations in the chart are being made by referencing the disclosure of Sung '026.

[1D] wherein a tip of each of the plurality of superabrasive particles aligns along a designated profile, with a tip variation of from about 5 microns to about 100 microns,	Sung '786 at 3:24-27 Sung '786 at 11:18-21, Claims 7-11.	Sung '817 at 13:5-10, 14:10-13, 14:14-16. Sung '074 at 13:4-9 Also, as discussed above, Petitioners have construed “designated profile” and tip variation therefrom as the “average protrusion distance of the diamond tips” (Pet. at 36-38.) Patent Owner does not agree with Petitioner’s construction but under Petitioners’ construction, Sung '074 also discloses the claimed range at 23:5-11.
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[1E] and 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,	Sung '786 at 19:10-12, 15-18 (disclosing a plurality of particles with a predetermined height greater than 20 microns and from about 1 to 20 microns) Note: “the plurality of superabrasive particles” must necessarily include “the highest protruding tip and the second highest protruding tip”. See also Sung '786 at 2:21-24, 11:6-10, 12:20-22, 23:16-19, 24:12-16, 27:1-4, claims 12-15. See also <i>id.</i> at Claim 17 (“the plurality of superabrasive particles are from about 30 microns to about 500 microns in size”) • In other words, the difference in protrusion distance between the highest and the second highest tip (or between the highest 1% protruding tips) can be between about 3 microns to about 50 microns (“10%”	See Limitation 1[D]. Also, as discussed with respect to Sung '786, Petitioners have construed “designated profile” and “tip variation” therefrom as the “average protrusion distance of the diamond tips” (Pet. at 36-38.) Patent Owner does not agree with Petitioner’s construction but under Petitioners’ construction, Sung '817 also discloses the claimed difference in protrusion distance. For example, for a difference in protrusion distance of 0-50 microns, Sung '817 discloses: • 14:14-15:4 As another example, for a difference in protrusion distance of 10-20 microns, Sung '817 discloses: • 14:29-15:1 As another example, for a difference in protrusion distance of 20-50 microns, Sung '817 discloses: • 14:24-26 In addition, Sung '074 discloses:
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	of “about 30 microns” to “10%” of “about 500 microns”; <i>see</i> claims 12 and 41). <i>See also id.</i> at Claims 32, 41 In addition, Petitioners have construed “designated profile” and “tip variation” as the “average protrusion distance of the diamond tips” (Pet. at 36-38.) Patent Owner does not agree with Petitioner’s construction but under Petitioners’ construction, Sung ’786 also discloses the claimed range. For example, for a difference in protrusion distance between 0-20 microns, Sung ’786 discloses: • Sung ’786 at 20:20-22 • <i>Id.</i> at Claims 21-33 For example, for a difference in protrusion distance between 20-40	• 10:10-17 • 9:22-25 • 9:25-29 <i>See also</i> Sung ’074 at 10:10-17 (disclosing “highest 1%” of protruding tips and “highest 100 protruding tips” each “within about 50 microns or less”) Note: “highest 1%” and “highest 100 protruding tips” necessarily include the second or next highest protruding tip.
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	microns, Sung '786 discloses: • Sung '786 at 13:3-4 • Claims 13, 14, 32, 42 As another example, for a difference in protrusion distance between 40-50 microns, Sung '786 discloses: • <i>See</i> Sung '786 at 13:12-14 and Claim 32 above. • Sung '786 at 13:34-14:1. • <i>See also id.</i> at Claims 12, 17, 41, 53.	
[1F] and the difference in protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles are within about 80 microns or less.	<i>See</i> Limitation 1[E]. Sung '786 at 19:12-18. • <i>Note:</i> “the plurality of superabrasive particles” must necessarily include the “highest 1% of the protruding tips”	<i>See</i> Limitation [1E]. Sung '817 at 14:14-21. Sung '074 at 3:15-20.

	In addition, based on Petitioners' construction of "designated profile" to mean the "average protrusion distance of the diamond tips" (Pet. at 36-38), Sung '786 also discloses the claimed range: • Sung '786 at 12:20-25.	
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1. Claim Limitations 1[E] and 1[F] Are Fully Supported by Sung '817 and Sung '786

In granting Institution, the Board found preliminarily that claim limitations 1[E] and 1[F] are not disclosed in either of Dr. Sung's previous applications in the same family as the '802 patent. (Institution Decision at 40-47.) However, the evidence of record supports that even where the precise language of claim 1 is not present in Dr. Sung's previous applications, both are sufficiently detailed, individually, to inform a POSA at the time of each application that Dr. Sung was in possession of all elements of claim 1. Sung '817 and Sung '786 would have each informed a POSITA, as of the filing date of each application, that Dr. Sung conveyed with reasonable clarity to those of skill in the art that he was in possession of the subject matter of the claims. *See Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64, 19 U.S.P.Q.2D (BNA) 1111, 1117 (Fed. Cir. 1991).

a. Sung '817 Shows that Dr. Sung Was in Possession of Claim Limitation [1E]

A POSITA would conclude that the applicant had possession of the subject matter of claim limitation 1[E] of the '802 patent based on the disclosures of Sung '817. (Ex. 2011 at ¶ 58.)

Sung '817 includes the following disclosures:

As such, in one aspect a majority of the plurality of cutting elements is arranged such that the tips vary from the designated profile by from about 1 micron to about 150 microns . . . [or] from about 5 microns to about 100 microns.

(Sung '817 at 14:14–16.)

In yet another aspect, the plurality of cutting elements are arranged such that their tips vary from the designated profile by from about 10 microns to about 75 microns . . . from about 10 microns to about 50 microns . . . from about 50 microns to about 150 microns . . . from about 20 microns to about 100 microns . . . from about 20 microns to about 50 microns . . . from about 20 microns to about 40 microns . . . by less than about 20 microns . . . by less than about 10 microns . . . by less than about 5 microns . . . [or] by less than about 1 micron . . . [or] less than about 10% of the average size of the superabrasive particles.

(*Id.* at 14:16-15:4.)

While these disclosures relate to variation from a designated profile, rather than variation between protrusion heights, a POSITA would know that the claimed difference in protrusion distance of “less than or equal to about 50 microns” between the highest and second highest tips are supported by the foregoing portions of the Sung '817. (Ex. 2011 at ¶ 59.)

This is because any two tips that vary from a reference point (whether it is the designated profile or another vantage point) would necessarily yield a height difference between those two tips. (*Id.* at ¶ 60.)

For example, any two tips that vary “from about 20 microns to about 50 microns” from a designated profile (e.g., a “planar designated profile” as alluded to by Dr. Shanfield; *see* Ex. 2008 at ¶ 115) would mean that their height difference would at least be between about 0 microns (e.g., where they both have the same height of about 20 microns) and about 50 microns (e.g., where one tip perfectly aligns with the designated profile and the other is above the designated profile by about 50 microns), which is prescribed in this range of “about 20 microns to about 50 microns”). (*Id.* at 61.)

As another example, any two tips that vary “by less than about 20 microns” from a designated profile would mean that their height difference would at least be between about 0 micron (e.g., where they both have the same height of about 20 microns) and about 40 microns (e.g., where one tip is below the designated profile by about 20 microns and the other is above the designated profile by about 20 microns). Hence, a POSITA would know that protrusion distances of from about 1 micron to about 150 microns, about 5 microns to about 100 microns, less than about 20 microns, less than about 10 microns, or from about 20 microns to about 50 microns all provide sufficient written support for claim limitation 1[E] of “less

than or equal to about 50 microns” as of the date of Sung ’817. (*Id.* at ¶ 62; *see also* Ex. 2001 at 13:5-8 (“It may also be beneficial for the cutting elements to protrude from the solidified organic material layer to a predetermined height or series of heights that is/are along a designated profile.”).)

As to the disclosure of the height relationship between the highest and the second highest tips, Sung ’817 is clear that “the term ‘tip’ is intended to **include the highest protruding point** of a superabrasive particle . . .” (Ex. 2011 at ¶ 63 (quoting Sung ’817 at 14:10-13).) In other words, those ranges (and their differences) cited above are measured with respect to the highest protruding tip (i.e., at least one of the two tips as discussed in the above examples necessarily is the highest protruding tip). (Ex. 2011 at ¶ 63.)

Also, in the portions cited above, Sung ’817 describes that the cutting elements “are arranged such that their tips vary from a designated profile,” affirming that the disclosed ranges are in relation to all tips, which necessarily include the second highest tip. (*Id.* at ¶ 63.) Based on this disclosure, a POSITA would readily conclude that a disclosed difference in protrusion distance of about 0 to 50 microns (as illustrated in the above examples) between all tips would provide sufficient written support for a difference in protrusion distance between the two highest tips is “less than or equal to about 50 microns” because a POSITA would know that the ranges of tip variation as taught in Sung ’817 would encompass all

of the asperities, including those with the highest and second highest tips. (*Id.* at ¶ 63.)

That both the Petitioner and the Board also rely on the designated profile (of Tsai) for purportedly disclosing a tip variation of between 5 microns and 100 microns (for claim limitation 1[D]; *see* Petition at 37-38 and Institution Decision at 64) reinforces that the designated profile provides the disclosure of the claimed difference in protrusion distance as recited in claim limitation 1[E] of the '802 patent .

b. Sung '817 Shows that Dr. Sung Was in Possession of Claim Limitation [1F]

A POSITA would also conclude that the applicant had possession of the subject matter of claim limitation [1F] of the '802 patent based on the disclosures of Sung '817. (Ex. 2011 at ¶ 65.) Sung '817 includes the following disclosures:

In another aspect, the plurality of cutting elements are arranged such that their tips vary from the designated profile by from about 5 microns to about 100 microns . . . from about 10 microns to about 75 microns . . . [or] from about 10 microns to about 50 microns. . . .

(Sung '817 at 14:16-21.)

A POSITA would know that the foregoing disclosure provides sufficient written support for the subject matter of claim limitation [1F] because the above disclosure references “the plurality of cutting elements,” which covers all of the tips, including the highest 1%. (Ex. 2011 at ¶ 66.) In addition, for the same reasons

discussed above with respect to claim limitation 1[E], information about how tips vary from the designated profile would provide information on a height difference between those two tips. (*Id.* at ¶ 66.)

For example, any two tips that “vary from the designated profile by from about 5 microns . . . to about 75 microns” would mean that their height difference would at least be between about 0 micron (e.g., where they both have the same height of about 5 microns) and about 80 microns (e.g., where one tip is below/above the designated profile by about 5 microns and the other is above//below the designated profile by about 75 microns). (*Id.* at ¶ 66.) A POSITA would also know that these ranges as taught in Sung ’817 would necessarily encompass all tips, including the highest 1% which Dr. Shanfield agrees and adopts in his declaration. (*Id.* at ¶ 66; see Ex. 1002 at ¶ 142 (“With respect to limitation [1F], since Tsai’s tip-to-tip variation for all superabrasive particles on the CMP pad dresser is about 19.8 microns in the example shown in Figure 6, and can be less than about 15 microns, the difference in protrusion distance between the highest 1% of protruding tips must also be about 19.8 microns (or less than 15 microns), which is within the claimed range in [1F] of about 80 microns or less”).)

c. Sung ’786 Shows that Dr. Sung Was in Possession of Claim Limitation [1E]

As a preliminary matter, Samsung’s position that Sung ’786/Sung ’026 does not disclose [1E] is undermined by the position it has taken in IPR2024-0534, where

it argues that Sung '026 discloses claim element [1C] of U.S. Patent No. 9,138,862 (the “’862 Patent”). (IPR2024-0534, Petition (Ex. 2012) at 30-36.) Element [1C] of the ’862 Patent is substantially identical to element [1E] of the ’802 patent:

’862 Patent	’802 Patent
[1C] 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 <i>about 10 microns</i>	[1E] 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 <i>about 50 microns</i>

The only difference between the relevant claim language is the narrower range of “about 10 microns” in claim 1 of the ’862 Patent compared to the “about 50 microns” in claim 1 of the ’802 Patent. Moreover, Samsung’s reasoning that “Sung ’026 teaches that tip-to-designated profile variation is less than 1 micron for each of the superabrasive particles” (*id.* at 32), would apply equally to the range recited in ’802 claim limitation [1E] here, because the recited range is ***broader*** than in ’862 claim limitation [1C]. By making this argument in a parallel IPR based on the same reference, Samsung has ***waived any argument*** that ’802 element [1E] here is not supported by Sung ’026/Sung ’786.³

³ Samsung’s reasoning also runs contrary to the Board’s determination that Sung ’786 does not support claim element 1[E] of the ’802 patent because “[n]one of the cited ’786 Application disclosures directly pertains to the difference in protrusion distance between the two highest particle tips being less than or equal to about 50 microns, as recited in limitation [1E].” (Institution Decision at 44.)

Moreover, there are independent reasons why a POSITA at the time of Sung '786 would have understood that Dr. Sung was in possession of the subject matter recited in claim limitation [1E]. First, similar to Sung '817, Sung '786 discloses:

As such, in one aspect a majority of the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 1 micron to about 150 microns. In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 5 microns to about 100 microns . . . from about 10 microns to about 75 microns . . . from about 10 microns to about 50 microns . . . from about 50 microns to about 150 microns . . . from about 20 microns to about 100 microns . . . from about 20 microns to about 50 microns . . . from about 20 microns to about 40 microns . . . by less than about 20 microns . . . by less than about 10 microns . . . by less than about 5 microns . . . by less than about 1 micron . . . [or] less than about 10% of the average size of the superabrasive particles.

(Ex. 2009 at 12:24-13:14; *see also id.* at 12:22-24 (disclosing a variation “from the designated profile by from about 1 micron to about 150 microns”).)

Based on the foregoing disclosures, a POSITA would know that Sung '786 provides written support for the subject matter recited in claim limitation 1[E] for the same reason that Sung '817 provides written support for the subject matter recited in claim limitation 1[E]. (Ex. 2011 at ¶ 71.) This is because, as illustrated in the examples discussed with respect to Sung '817, the protrusion distance of two tips between relative to the designated profile would necessarily yield information about the difference in their protrusion distances. (*Id.* at ¶ 71.) Since Sung '786

discloses the same ranges as those in Sung '817, the examples discussed with respect to Sung '817 apply equally to Sung '786. (*Id.* at ¶ 71.)

In addition, Sung '786 provides written support for claim limitation 1[E] in the form of particle size. (Ex. 2009 at 13:34-14:4 (“[I]n one aspect the plurality of superabrasive particle may be from about 30 microns to about 500 microns in size . . . from about 100 microns to about 200 microns in size . . . [or] substantially the same size.”).) When combined with Sung '786’s disclosure that the tips can also “vary from the designated profile to less than about 10% of the average size of the superabrasive particles” (*id.* at 13:12-14), a POSITA would understand that the tips, including the two highest tips, could vary from about 0 micron (e.g., where the tips have the same size) to about 50 microns (e.g., 10% of 500 microns) with respect to the designated profile. (Ex. 2011 at ¶ 72.) A POSITA would understand that this range would necessarily cover the difference in protrusion distance between the two highest tips (e.g., where the highest tip is 50 microns above the designated profile and the second highest tip is of the same height as the designated profile (i.e., about 0 micron), which would yield “less than or equal to about 50 microns” in their difference in protrusion distance as recited in claim limitation 1[E]). (*Id.* at ¶ 72.)

This conclusion is consistent with Sung '786’s disclosure that “particle tip height variations of more than 50 μm . . . would render a dresser useless if it were

required to dress a CMP pad and achieve a uniform asperity depth of 20 μm or less, for example.” (Ex. 2011 at ¶ 73 (quoting Ex. 2009 at 2:21-24).) A POSITA would understand that the aim of Sung ’786 is to provide a dresser with tip height variations of less than 50 microns in order to achieve a uniform asperity depth of 20 μm or less. (Ex. 2011 at ¶ 73.)

For example, Sung ’786 teaches that “the predetermined height may produce a cutting depth of less than about 20 microns . . . [or] from about 1 micron to about 20 microns when used to abrade a work piece.” (Ex. 2011 at ¶ 74 (quoting Ex. 1009 at 11:6-10).) Hence, a POSITA would understand that in order to achieve these cutting depths, the variation in particle heights across the pad dresser could not exceed about 50 microns. (*Id.* at ¶ 75.) Since the total variation in particle heights cannot not exceed 50 microns, it follows that the variation in particle heights between the highest and second highest tip also cannot exceed 50 microns. (*Id.* at ¶ 75.)

Finally, Sung ’786 discloses that “the plurality of superabrasive particles may be arranged such that their tips protrude to less than about 40 microns . . . to less than about 30 microns . . . to less than about 20 microns” (Ex. 2009 at 3:25-33), all of which provide additional written support for the claim range of “less than or equal to about 50 microns as recited in claim limitation 1[E] (and 1[F] as discussed below).

d. Sung ’786 Shows that Dr. Sung Was in Possession of Claim Limitation 1[F]

As a preliminary matter, Samsung’s position that Sung ’786/Sung ’026 does not disclose claim limitation 1[F] is also undermined by the position it has taken in IPR2024-0534 with respect to claim limitation [1C] of the ’862 Patent. (Ex. 2012 at 33.) There are minimal differences between the relevant claim language in claim 1 of the ’862 Patent and claim 1 of the ’802 Patent. Claim 1 of the ’862 patent again recites a **narrower** range of protrusion distances than claim 1 of the ’802 patent:

'862 Patent	'802 Patent
[1C] and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are [sic] within about 20 microns or less ; and	[1F] the difference in protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles are within about 80 microns or less

Samsung’s reasoning that “because the tip-to-tip variation for **each** of the superabrasive diamond particles is less than 2 microns, the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles must also be less than 2 microns, which is within the claimed ‘about 20 microns or less’” (Ex. 2012 at 34), would apply equally to the “highest 1% of the protruding tips” recited in claim limitation [1F] of the ’802 Patent. Where the difference in protrusion distance between **all** protruding tips is less than two microns, then the difference between the highest 1% of protruding tips is also necessarily less than two microns, and therefore less than eighty microns. Thus, as in the case of

claim limitation [1E], Samsung has ***waived any argument*** that that '802 element [1F] is not supported by Sung '026/Sung '786.

Moreover, there are also independent reasons why a POSITA at the time of Sung '786 would have understood that Dr. Sung was in possession of [1F]. First, similar to Sung '817, Sung '786 discloses:

In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 5 microns to about 100 microns . . . from about 10 microns to about 75 microns . . . [or] from about 10 microns to about 50 microns. . . .

(Sung '786 at 12:24-30; *see also id.* at 12:22-24 (disclosing a variation “from the designated profile by from about 1 micron to about 150 microns”).)

Based on the foregoing disclosures, a POSITA would know that Sung '786 provides written support for the subject matter recited in claim limitation 1[F] for the same reason that Sung '817 provides written support for the subject matter recited in claim limitation 1[F]. (Ex. 2011 at ¶ 77.) This is because, as illustrated in the examples discussed with respect to Sung '817, the protrusion distance of two tips between relative to the designated profile would necessarily yield information about the difference in their protrusion distances. (*Id.* at 77.) Since Sung '786 discloses the same ranges as those in Sung '817, the examples discussed with respect to Sung '817 apply equally to Sung '786. (*Id.* at 77.)

For example, any two tips that “vary from the designated profile by from about 5 microns . . . to about 75 microns” would mean that their height difference would

at least be between about 0 micron (e.g., where they both have the same height of about 5 microns) and about 80 microns (e.g., where one tip is below the designated profile by about 5 microns and the other is above the designated profile by about 75 microns). (*Id.* at 78.)

A POSITA would also know that these ranges as taught in Sung '786 would necessarily encompass *all* tips (e.g., as supported by Sung '786's language of "the *plurality* of superabrasive particles"), including the highest 1% (Ex. 2011 at ¶ 79), which Dr. Shanfield agrees and adopts in his declaration. (Ex. 1002 at ¶ 142 ("With respect to limitation [1F], since Tsai's tip-to-tip variation for all superabrasive particles on the CMP pad dresser is about 19.8 microns in the example shown in Figure 6, and can be less than about 15 microns, the difference in protrusion distance between the highest 1% of protruding tips must also be about 19.8 microns (or less than 15 microns), which is within the claimed range in [1F] of about 80 microns or less").)

In addition, Sung '786 provides written support for claim limitation 1[F] in the form of cutting depth. As discussed above, a POSITA would understand from the Sung '786 disclosure that in order to achieve "a cutting depth of less than about 20 microns . . . [or] from about 1 micron to about 20 microns when used to abrade a work piece," the variation in particle heights across the pad dresser could not exceed about 50 microns. (Ex. 2011 at ¶ 80.) Because Sung '786 discloses a maximum cutting depth

of about 20 microns, coupled with a maximum tip height of about 50 microns, a POSITA would know that the highest 1% of protruding tips are within 80 microns or less (e.g., 20 microns + 50 microns = 70 microns). (*Id.* at ¶ 81.)

Based on the disclosures of Dr. Sung’s earlier applications, a POSITA would have been sufficiently informed of the subject matter of claim 1 well before the filing date of the ’802 patent. (*Id.* at ¶ 56.) Nor would a POSITA have required the exact language of claim elements [1E] and [1F] to recognize that Dr. Sung was in possession of all of the elements of claim 1. *See Union Oil Co. of Cal. v. Atlantic Richfield Co.*, 208 F.3d 989, 997 (Fed. Cir. 2000), citing *In re Gosteli*, 872 F.2d 1008, 1012 (Fed. Cir. 1989) (“The written description requirement does not require the applicant ‘to describe exactly the subject matter claimed, [instead] the description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed.’”)

B. Claims 2-7 and 13-21 Have Written Support from Sung ’026 and Sung ’817 and Is Thus Entitled to a Priority Date of Sept. 9, 2005 and Nov. 16, 2006, Respectively

Dependent claims 2-7 and 13-21 are also fully supported by Sung ’026 and Sung ’817. Hence, claims 2-7 and 13-21 are entitled to a priority date as early as Sept. 9, 2005 but no later than May 23, 2011. Below is a chart reflecting the written support for claims 2-7 and 13-21 from these priority applications:

'802 claim element	US Patent Application 11/223,786 (filed on Sep. 9, 2005)	US Patent Application 11/560,817 (CIP of '786) (filed on Nov. 16, 2006)
2. The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip is less than or equal to about 10 microns.	See Limitations [1E] and [1F].	See Limitation [1E]. <i>See also</i> Sung '817 at 16:26-30 <i>Id.</i> at 18:21-23
3. The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip is less than about 10 microns.	See Limitations [1E] and [1F].	See Limitations [1E] and [1F] and claim 2.
4. The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and the 10th highest protruding tip is less than or equal to about 20 microns.	See Limitations [1E] and [1F]. <i>See also</i> Sung '786 at 3: 27-29 <i>Id.</i> at Claims 5, 6, 15	See Limitations [1E] and [1F] and claim 2.
5. The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and	See Limitations [1E] and [1F] and Claim 4.	See Limitations [1E] and [1F] and Claim 2.

the 100th highest protruding tip is less than or equal to about 40 microns.		
6. The dresser of claim 1, wherein the plurality of superabrasive particles includes a plurality of working superabrasive particles, such that rotating the dresser against a CMP pad cuts asperities into the CMP pad having a cutting depth of less than or equal to about 50 microns.	Sung '786 at 3:18-23 Sung '786 at 11:5-12 Claims 4-5.	<i>Id.</i> at 12:21-29 Claim 14
7. The dresser of claim 6, wherein the cutting depth is from about 10 microns to about 50 microns.	See Claim 6.	See Claim 6.
13. The dresser of claim 1, wherein the highest protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of from about 10 microns to about 50 microns.	See Limitations [1E] and [1F]. See also Sung '786 at 12:28-30	See Limitations [1E] and [1F] and claim 2. See also 14:19-21
14. The dresser of claim 1, wherein the highest protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of from about 20 microns to about 40 microns.	See Limitations [1D]. See also Sung '786 at 3:24-29 Sung '786 at 13:3-4	See Limitation [1D]. See also <i>id.</i> at 14:27-28
15. The dresser of claim 1, wherein the highest	See Limitation [1D] and claim 14.	See Limitation [1D] claim 14.

protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of less than about 20 microns.		
16. The dresser of claim 1, wherein the protrusions of the plurality of superabrasive particles produce cutting depths of less than about 20 microns when used to abrade a CMP pad.	See Claim 6.	See Claim 6.
17. The dresser of claim 1, wherein the protrusions of the plurality of superabrasive particles produce cutting depths of from about 1 micron to about 20 microns when used to abrade a CMP pad.	See Claim 6.	See Claim 6.
18. The dresser of claim 1, wherein the protrusions of the plurality of superabrasive particles produce cutting depths of from about 10 microns to about 20 microns when used to abrade a CMP pad.	See Claim 6 above. Sung '786 at 3:21-23 See also Claim 6.	See Claim 6.
19. The dresser of claim 1, wherein the designated profile includes a configuration selected from the group consisting of a plane, a slope, a curved shape, a dome	See Limitation [1D].	See Limitation [1D].

shape, and combinations thereof.		
20. The dresser of claim 1, wherein the plurality of superabrasive particles is arranged across the support substrate in a predetermined pattern.	Claim 20 Sung '786 at 4:22-31	<i>Id.</i> at 27:27-26:2
21. The dresser of claim 20, wherein the predetermined pattern includes an even distribution of the plurality of superabrasive particles spaced at a distance of from about 100 microns to about 800 microns.	Sung '786 at 15:18-20 Claims 26/45	

C. Claims 8-12 Cover Subject Matter Unique to the '802 Patent

As noted above, certain claims recite new subject matter unique to the '802 Patent; namely, the specific **numbers** of “working superabrasive particles” as claimed in claims 8-12 and as disclosed in the specification of the '802 Patent:

As yet another exemplary aspect of the present disclosure, a CMP pad dresser can include a rigid support substrate and a monolayer of a plurality of superabrasive particles coupled to the support substrate, where the plurality of superabrasive particles includes a plurality of working superabrasive particles . . . [that] include[] at least 100 working superabrasive particles . . . at least 1000 working superabrasive particles . . . from about 1000 to about 6000 working superabrasive particles . . . from about 2000 to about 5000 working superabrasive particles [or] at least about 1000 working superabrasive particles that protrude from the rigid support substrate to distances within about 30 microns of one another.

(’802 Patent at 2:55-3:9.) Additional new subject matter is also disclosed in another portion of the specification which teaches a plurality of superabrasive particles including at least 100/300/500/1000 working superabrasive particles, from about 2000 to about 5000 working superabrasive particles, from about 2000 to about 5000 working superabrasive particles, or at least about 1000 working superabrasive particles. (*Id.* at 13:58-14:15.) Thus, the new subject matter as recited in claims 8 through 12 of the ’802 Patent is easily identified.

Dr. Sung’s declaration filed in the *Sung v. Kinik* matter did **not** disclaim “all earlier priority dates” because Dr. Sung’s statement that the ’802 Patent contained “new subject matter” is consistent with the disclosures of the ’802 Patent and the nature of it being a CIP. Nor did the court’s opinion in *Sung v. Kinik* affirm a single priority date for all claims of the ’802 Patent based on Dr. Sung’s declaration. Indeed, the *Sung v. Kinik* court expressly found that “there is a **possibility** of the infrequent posture that ***the alleged infringer will be the one arguing for the earlier priority date,***” (Ex. 1019 at 2) leaving the door open for an “earlier priority date.” Coupled with the fact that the *Sung v. Kinik* court ***did not adjudicate the substance of the priority claim at issue here,*** there is no controlling authority that supports Petitioners’ contention for a single priority date, let alone being the filing date of the ’802 Patent.

Nor was Dr. Sung's Patent Owner's Preliminary Response in IPR2021-00638 a waiver of earlier priority dates, as Petitioners argue. In that case, Dr. Sung did **not** address the merits of Kinik's invalidity arguments at all; nor was it necessary because Patent Owner argued that Kinik lacked standing to petition for *inter partes* review based on Kinik's then-unresolved claim of ownership of the '802 Patent. (Ex. 2003 at 1.) A patent owner can permissibly reserve arguments for a Patent Owner's Response post-institution to which waiver **only** applies. This is because a patent owner preliminary response is optional, and that "[a] patent owner may expedite the proceeding by filing an election to waive the patent owner preliminary response." 37 C.F.R. § 42.107.

In sum, the intrinsic record clearly delineates those portions of the specification of the '802 Patent that are new subject matter and those that originated from Sung '786, Sung '817, and/or Sung '074 application(s). Accordingly, only claims 8-12 are derived from new subject matter and have a priority date of Oct. 3, 2014 based on the '802 Patent's filing date. By contrast, claims 1-7 and 13-21 have priority dates as early as Sept. 9, 2005 and no later than May 23, 2011.

D. Each of the CIPs Leading to the '802 Patent Was Co-pending With Its Parent Application

In its Institution Decision, the Board requested that the parties address the issue of "whether there are the requisite intervening application(s) per [*Hollmer v.*

Harari, 681 F.3d 1351 (Fed. Cir. 2012)] and related case law” to support a priority date earlier than the filing date of the ’802 patent. (Institution Decision at 48.)

Hollmer does not change the result here. In *Hollmer*, the priority claim for the ’880 patent at issue was based on new matter that had been *incorporated by reference* from the ’579 application, an application from *outside* of the chain of applications to which the ’880 patent claimed priority—critical facts that are absent here. *Hollmer*, 681 F.3d at 1353. What is more, several of the intervening applications lacked any reference to the ’579 application. *Id.* at 1354. Consequently, the Federal Circuit found that the intervening applications were not “copending” with the ’579 application, depriving the ’880 patent of the benefit of the earlier priority date of the first application in the chain. *Id.* at 1358. Here, by contrast, there is: 1) a direct chain of priority between each of the applications leading to the ’802 patent; 2) no break in the priority chain of the kind at issue in *Hollmer* and 3) no new matter was incorporated from outside of family of applications to which the ’802 patent claims priority.

Samsung does not argue that Dr. Sung inserted new matter from an application outside the family in his ’802 application, nor has Dr. Sung relied on incorporation by reference of any subject matter to support his priority claim here. Nevertheless, to the extent that the holding of *Hollmer* simply restates the requirement that each individual CIP must be co-pending with its parent, that

requirement is met because none of the applications in the chain between Sung '817, Sung '786, and the '802 patent either issued as a patent or was abandoned prior to the filing of the successive CIP in the chain. *See* 35 U.S.C. § 120.

IV. TSAI DOES NOT ANTICIPATE THE CHALLENGED CLAIMS BECAUSE TSAI IS NOT QUALIFIED AS PRIOR ART

A. Tsai Is Not Prior Art to Claims 1-3 and 13-21

As shown above, claims 1-3 and 13-21 of the '802 Patent claim subject matter that was disclosed entirely in Dr. Sung's prior Sung '026, Sung '817 and/or Sung '074 application(s) and accordingly have priority dates as early as Sept. 9, 2005 but no later than May 23, 2011.

According to Petitioners, Tsai was published on January 10, 2012 (Pet. at 3). Accordingly, Tsai is ***not*** prior art because Tsai was published after the priority dates of the '802 Patent. *See* 35 U.S.C. § 102(a)(1).⁴

B. Under Samsung's Asserted Priority Date, Tsai Also Does Not Anticipate Claims 1-5, 13, 15 and 19-21

Even if Samsung's erroneous assertion that all of the claims of the '802 Patent have a single priority date of October 3, 2014 has merit, Tsai still does not anticipate or render the claims of the '802 Patent obvious. In particular, Tsai does not teach or disclose, nor is it obvious to provide, a (1) "designated profile"; (2)

⁴ The result would be the same under pre-AIA § 102(a), which would apply to claims 1-3 and 13-21 based on their effective filing date.

“tip variation” from the designated profile; and (3) specific protrusion distances as recited in claims 1-5, 13, 15, and 19-21 of the ’802 Patent.

1. Tsai Does Not Teach or Suggest the Claimed “Designated Profile”

There is no explicit disclosure of a “profile” or “designated profile,” let alone of “a tip of each of the plurality of superabrasive particles [that] aligns along a designated profile” *anywhere* in Tsai. (Ex. 2011 at ¶ 31.) In fact, the only basis for Petitioners’ assertion that Tsai contains this element is Dr. Shanfield’s addition of a red line to Fig. 2e of Tsai which he contends represents a “designated profile.” (Pet. at 37, citing Ex. 1002 at ¶¶ 131-132.) But Dr. Shanfield’s annotation cannot substitute for the absence of this element from Petitioners’ principal reference, which is fatal to its anticipation ground.

Prof. Ming-Yi Tsai, the lead author of this reference and Patent Owner’s expert, confirms under oath that there is *no designated profile in Tsai, nor any mention of a profile or contour*. (Ex. 2011 at ¶ 31, 33.) Samsung’s and its expert’s argument that a designated profile is purportedly present in Tsai based solely upon the levelling of superabrasive particles in Tsai’s ODD fundamentally mischaracterizes the significance of “levelling” and “leveled” particles. (*Id.* at ¶ 21.)

First, Tsai does not describe or show diamond grits “leveled to the same height.” (*Id.* at ¶ 22 (quoting Institution Decision at 41).) On the contrary, Tsai

states that “[a]lthough conventional diamond conditioners consist of regularly distributed diamond grits, the grit tips are **not** leveled to the same height.” (*Id.* at ¶ 22 (quoting Ex. 1004 at Abstract).)

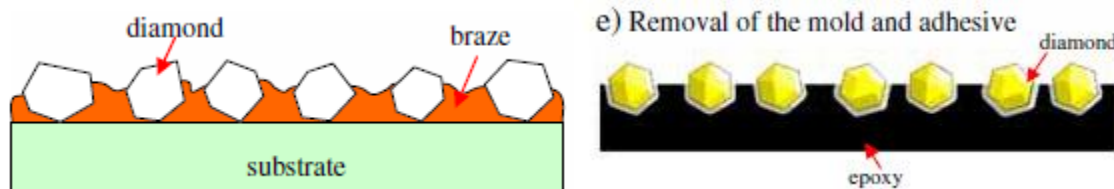
Also, the leveling described in Tsai refers to reducing overall tip variation between the tip heights of diamond grits across the face of a CMP disk. (*Id.* at ¶ 23.) That is why in the case of the ODD, “the diamond tips can be **leveled** by compressing the disk with a flat plate **to reduce the variation in the heights of the diamond tips.**” (*Id.* at ¶ 23 (quoting Ex. 1004 at 6:8-10).) This passage shows that the objective of levelling is to reduce the variation but not to eliminate it entirely such that all of the diamond tips have the same height. (Ex. 2011 at ¶ 23.) Similarly, the abstract refers to “[d]iamond levelling” as “height distribution of diamond grits” (Ex. 1004 at Abstract), which presumes that there are multiple heights of diamond grits across the face of the disk. (Ex. 2011 at ¶ 23.)

Tsai also describes why a reduction in variation between the tip heights of a diamond grits represents an improvement in CMP pad conditioning. (*Id.* at ¶ 24.) While “[a] typical diamond disk contains over 10,000 grits; however, less than 10% of the diamond grits are engaged in cutting the polishing pad.” (*Id.* at ¶ 24 (quoting Ex. 1004 at 2:14-16).) By contrast, “it can be inferred that the ODD can stabilize the wafer removal rate while consuming less pad material, thus resulting in a long pad lifespan.” (Ex. 2011 at ¶ 24 (quoting Ex. 1004 at 10:1-3).)

Tsai does not assume that reverse casting was intended to create conditioners with a single height for all diamond grits. (Ex. 2011 at ¶ 25.) And reducing the variation in tip heights does not require a designated profile or contour along which the tip heights of the diamond grits in an ODD are aligned or intended to align. (*Id.* at ¶ 25.) That is because, as stated above, levelling refers to reducing the **overall** variation in tip heights irrespective of any tip alignment. (*Id.* at ¶ 25.)

In addition, Figure 2 of Tsai does not represent the actual distribution of tip heights across the face of an ODD. (*Id.* at ¶ 26.) The purpose of Figure 2 is to illustrate the steps in the process of reverse casting. It was not intended to illustrate the alignment of diamond tips along a contour or the actual variation in diamond tip height across the disk. Moreover, Figure 2 is not drawn to scale. (*Id.* at ¶ 26.)

That this is the case is shown by reference to Fig. 1, which shows the conventional brazed diamond disk (BDD). (*Id.* at ¶ 27.) The comparable sections of Figures 1 and 2 are shown alongside one another below:



(Ex. 1004 at Fig. 1 and Fig. 2.)

It cannot be the case that **both** the BDD in Figure 1 and the ODD in Figure 2 have grits with the **same** heights across each respective disk. (Ex. 2011 at ¶ 28.) Yet Samsung's argument that Fig. 2 reflects the actual height variation of the diamond tips on the ODD only makes sense if Fig. 1 also represents the actual height variation of the diamond grits across the BDD. (*Id.* at ¶ 28.) That would not be possible because "[t]he height variation in the diamond tips of the ODD is significantly smaller than that in the diamond tips of the BDD." (*Id.* at ¶ 28 (quoting Ex. 1004 at 8:19-22).)

The actual variation in tip heights between a BDD and an ODD is shown in Figures 5 and 6 and in Section 5 of Tsai. (*Id.* at ¶ 29.) The text accompanying those images explains that "[t]he height variation in the diamond tips of the ODD is significantly smaller than that in the diamond tips of the BDD." (Ex. 1004 at 8:19-22.) Specifically, "[i]n the case of the BDD, the diamond tips are leveled to more than 50 μm . However, as shown in Fig. 6, in the case of the ODD, the diamond tips of the ODD can be leveled to less than 15 μm because the diamond tips are already leveled." (*Id.* at 8:22-24.)

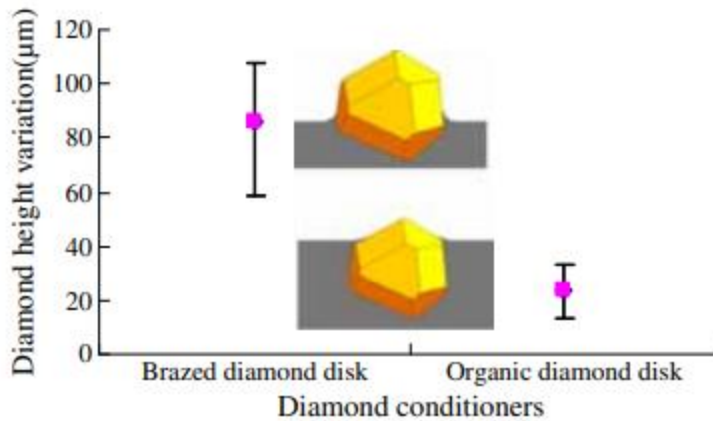


Fig. 6. Height variation in tips for diamond conditioners.

(Ex. 1004 at Fig. 6.)

Samsung describes the leveling of diamond grits disclosed in Tsai as equivalent to claim element 1[D] of the '802 patent, which recites a “a tip of each of the plurality of superabrasive particles aligns along a designated profile.” (Pet. at 36.) However, Tsai makes no mention of a profile or contour of any kind, nor does it teach that its particles must align in any specific way. (Ex. 2011 at ¶ 31.) That is because Tsai is concerned with reducing the overall variation in diamond tip height, not with causing the diamond tips to arrange along a specific profile or contour. (Ex. 2011 at ¶ 31.)

Dr. Shanfield takes the average of the tip heights of the ODD, which is represented in Fig. 6 by a purple square lying between the maximum and minimum values of diamond tip heights, to be a “designated profile.” (Ex. 1002 ¶ 133.) But the average tip height indicated in Fig. 6 does not represent a target against which the levelled tips of the ODD were intended to align. (Ex. 2011 at ¶ 32.) That

average was calculated *after* the reverse casting process was complete, based on measurements taken of the tip heights of the finished ODD. (*Id.* at ¶ 32.) It was incidental to the reduction of overall tip heights. (*Id.* at ¶ 32.) The average was not predetermined in advance as a level or contour at which the diamond tips would align. (*Id.* at ¶ 32.)

Moreover, diamond tips with a height variation of 15 µm across an ODD would not align along a flat contour as Samsung contends. (*Id.* at ¶ 33.) Even though the variation in tip protrusion heights of an ODD is lower than for a BDD, a variation of 15µm in Tsai still would not permit the tips to align along a flat profile, which requires that all the tips have the same height. (*Id.* at ¶ 33.)

That reverse casting is distinct from the designated profile is evident from the written description of the '802 patent itself, which refers to reverse casting in in a different section of the specification from the one on the designated profile. (*Id.* at ¶ 34.) The specification refers to reverse casting as used to “orient and attach” diamond particles:

Additionally, so-called “reverse casting” methods can be used to accurately orient and attach the dressing segments to the support substrate. Such methods can include initially securing the plurality of dressing segments to a substrate using a “mask” material. The portions of the dressing segments protruding from the mask material can then be attached to the rigid support using the methods discussed herein, after which (or during which), the masking material can be removed.

(Ex. 1001 at 25:14-22.)

The '802 patent's teaching of reverse casting to "accurately orient and attach the dressing segments" is further evidence that the reverse casting method does not involve the designation or predetermination of a profile as Samsung would have it. (Ex. 2011 at ¶ 35.) If reverse casting required designating a profile, the '802 patent would have drawn that connection, but it does not. (*Id.* at ¶ 35.) Dr. Tsai confirms that the concept of a designated profile was not subject matter that he thought about when conducting the BDD and ODD analyses underlying the Tsai article. (*Id.* at ¶ 35.)

In sum, there is no indication that the ODD of Tsai or its predecessors was based on a "***predetermined***" or "designated" profile that would anticipate the challenged claims or render them obvious. (*Id.* at ¶¶ XX.)

And even if it could be argued that a random distribution or spread of diamond particles or grits with "***equal heights and identically shaped tips***" on Tsai's ODD would create a certain random profile or contour (and it would not), "***equal heights and identically shaped tips***" still would not satisfy claim 1 because "***equal heights and identically shaped tips***," like Dr. Shanfield's phantom "flat profile," would lead to ***no*** tip variation (i.e., 0 micron), which is not the claimed range of "from about 5 microns to about 100 microns."

2. Tsai Does Not Teach or Suggest the Claimed Tip Variation from a Designated Profile

In the Institution Decision, the Board concluded that “the claim term ‘tip variation’ must refer to Petitioner’s ‘tip-to-designated profile’ claim construction, not Petitioner’s ‘tip-to-tip’ claim construction.” (Institution Decision at 63.) Thus, Petitioner’s burden is to show that Tsai discloses tip variation from a designated profile, not simply tip-to-tip variation, as it has argued in the Petition.

Because Tsai does not teach or disclose a designated profile, it follows that Tsai also does not teach or suggest a tip variation from a designated profile, as elaborated above.

3. Tsai Does Not Teach or Suggest the Claimed Highest Protruding Tip, Second Highest Protruding Tip, the Highest 1% of the Protruding Tips and Difference in Protrusion Distance

Petitioners and Dr. Shanfield argue that Tsai purportedly discloses a “tip-to-tip variation of about 19.8 microns in Figure 6 and discloses that the variation can be less than 15 microns for all superabrasive particles,” and view these disclosures as meeting the claimed range for the claimed difference in protrusion distance between “the highest protruding tip and the second highest protruding tip” and between “the highest 1% of the protruding tips.” (Ex. 1002 at ¶¶ 140-142.)

As a preliminary matter, Tsai is completely silent on the highest, second highest, or highest 1% protruding tips.⁵ Tsai thus does not anticipate nor render the challenged claims obvious on this reason alone. Also, Dr. Shanfield’s argument holds no water because an “average protrusion height” (Ex. 1002 at ¶ 85) does not address the protrusion difference between two specific tips (namely, the highest and the second highest protruding tips) or a specific set of tips (namely, highest 1%) particularly where “[a] typical diamond disk contains over 10,000 grits.” (Ex. 1004 at 2:14-15.) Dr. Shanfield does not even provide a motivation for manufacturing these specific tips or set of tips with the claimed ranges.

In addition, the variation across multiple tips as claimed in the ’802 Patent is distinct from the values claimed in *Ineos* cited by Petitioners. In that case, the teaching of a prior art reference of a **single** value was found to anticipate a claimed range for a single value, “i.e. **a** lubricant in an amount between 0.05 and 0.5% by weight.” *Ineos USA LLC v. Berry Plastics Corp.*, 783 F.3d 865, 868 (Fed. Cir. 2015). That is distinct from claim 1 of the ’802 Patent, where “tip variation” encompasses **multiple** values of **multiple** superabrasive tips. Tsai’s disclosure of a

⁵ If consideration is to be given to Petitioners’ argument that Tsai need not be explicit about which diamond grit has the “highest” or “second highest protruding tip,” or the highest 1% of the protruding tips,” such consideration should also be given to Patent Owner’s evidence regarding entitlement of priority claim that it is sufficient to show that the disclosure in Sung ’026 and Sung ’074 of “the plurality of superabrasive particles,” for example, also encompasses the “highest” or “second highest protruding tip,” or the highest 1% of the protruding tips.”

single potential value of “less than 15 microns” is insufficient to show multiple values of distinct superabrasive tips and their variation from one another or from a designated profile. For that reason, *Ineos* is inapplicable and Tsai’s disclosure of a single value of a diamond tip cannot anticipate the claimed tip variation. See *Colas Sols., Inc. v. Blacklidge Emulsions, Inc.*, 759 Fed. Appx. 986, 990 n.7 (Fed. Cir. 2019) (“But the prior art here does not actually disclose a range of softening points.”).

C. Dependent Claims

Because Tsai does not teach or disclose many of the elements of independent claim 1, including a “designated profile,” “tip variation,” “highest protruding tip,” “second highest protruding tip,” “highest 1% protruding tips,” and the “difference in protrusion distance,” Petitioners’ first ground of unpatentability also fails with respect to all of the remaining challenged claims 2-5, 13, 15 and 19-21, all of which depend from claim 1.

1. Claims 2-5

Also claims 2-5 each require comparison of the protrusion distances of the “highest tip” on a CMP pad conditioner with another tip, such as the “second highest protruding tip” (claims 2 and 3), the “10th highest protruding tip” (claim 4), and the “100th highest protruding tip” (claim 5). Implicit in each of these claims is an assessment of the total number of diamonds on the pad conditioner.

For claims 4 and 5 only, Dr. Shanfield undertakes a series of calculations based on Figures 3, 5 and 8 of Tsai to estimate a total number of particles for the disks shown in each image. (Ex. 1002 at ¶¶ 153-58.) All of Dr. Shanfield's calculations assume that the individual segments of conditioning disks shown in these images are sufficiently representative of the entire disk that the same pattern and number of particles in those segments will be repeated across the entire disk.

In so doing, Dr. Shanfield and Samsung oversimplify and misinterpret Tsai. Tsai does not address any problem related to spacing; its primary concern was with levelling diamond tips. (Ex. 2011 at ¶ 39.) And Tsai's reverse casting method was not intended to produce a specific distribution, spacing or pattern of diamonds. (*Id.* at ¶ 39.) Tsai's reference to "regular distribution" (Ex. 1004 at 5:24), does not mean perfect distribution across the disk such that all spacing is identical. (Ex. 2011 at ¶ 41.) The distribution of the diamonds on the ODD is not perfectly regular. (*Id.* at ¶ 41.) Just as "levelling" does not mean "flat," "regular" in the context of Tsai does not mean "absolutely uniform distribution." (*Id.* at ¶ 41.)

Lacking any personal experience in the measurement and fabrication of CMP pad conditioners, Dr. Shanfield assumes a degree of precision in Tsai's disclosures which was never intended by its author and which ignores the realities of CMP pad conditioner fabrication. Even with "regular" tip spacing, the number of particles will vary from one section of the ODD to another. (*Id.* at ¶ 42.) And

the total number of particles can only be determined by counting all of the grits on a disk. (*Id.* at ¶ 42.)

In light of the unreliability of Dr. Shanfield’s estimates of the total number of diamond tips on Tsai’s ODD, Samsung has failed to meet its burden to show any basis on which the highest or second highest tips, let alone ten or hundred highest tips on Tsai’s ODD could be identified and measured. That is fatal to Samsung’s contention that claims 2-5 are anticipated or rendered obvious by Tsai.

2. Claims 20-21

Samsung’s contention that Tsai teaches “the plurality of superabrasive particles [] arranged across the support substrate in a predetermined pattern” in claim 20 and “the predetermined pattern includ[ing] an even distribution of the plurality of superabrasive particles spaced at a distance of from about 100 microns to about 800 microns” in claim 21 fails for substantially the same reasons as its arguments for claims 2-5.

Dr. Shanfield relies on the same images of partial segments of Tsai’s pad conditioners to argue that Tsai’s reverse casting “results in a predetermined pattern (e.g., a grid) across the epoxy resin support substrate” (Ex. 1002 at ¶ 165), and that “the superabrasive particles on Tsai’s CMP pad dressers are arranged in a grid with even inter-diamond spacing.” (*Id.* at ¶ 166.) However, as discussed above, Dr. Shanfield’s assumption that tip spacing will be uniform across the face of a pad

conditioner was not contemplated by Tsai and runs contrary to the realities of CMP pad conditioner fabrication. (*Id.* at ¶ 166.) And without any proof that the inter-diamond spacing of Figures 3, 5, and 8 was maintained in other segments of the disk, Samsung cannot show that there was even distribution of particles, let alone one within the precise range of spacing from about 100 microns to about 800 microns.

V. TSAI AND SUNG '026 DO NOT RENDER OBVIOUS CLAIMS 1-3, 6-14, AND 16-18

A. Sung '026 Is Not Prior Art to Claims 1-3, 6-7, or 16-18 Because Sung '026 Is the Grandparent of the '802 Patent

As set forth in Section III above, claims 1-3, 6-7, 13-14 and 16-18 are fully supported by the priority applications Sung '026/Sung '786 and Sung '817, of which the '802 Patent is a CIP. Accordingly, Tsai is not prior art to claims 1-3, 6-7, 13-14 and 16-18 of the '802 Patent.

Petitioners' secondary reference, Sung '026/Sung '786 is the *grandparent* of the '802 patent and to which the '802 Patent claims priority. As argued in Section III above, Sung '026/Sung '786 fully supports claims 1-3, 6-7, 13-14 and 16-18 of the '802 Patent and those claims are not based on new subject matter. Therefore, Sung '026/Sung '786 is not prior art to claims 1-3, 6-7, 13-14 and 16-18. Also, as detailed at length in Section III above, Dr. Sung did not disclaim, nor could he have disclaimed, the subject matter of his earlier applications. Instead, Petitioners'

argument rests on a skewed misreading and intentional mischaracterization of Dr. Sung's declaration. Accordingly, Sung '026/Sung '786 is not prior art to claims 1-7 and 13-21 and cannot render these claims obvious.

Only claims 8-12 of the '802 Patent recite new subject matter with a priority date that falls after the publication date of Tsai and the filing date of Sung '026/Sung '786. *See* Section III above. However, Tsai and Sung '026/Sung '786, alone or in combination, do not teach or suggest the claimed “plurality of working superabrasive particles” in claims 8-12, let alone the specific numbers of “working superabrasive particles” recited therein.

B. Tsai and Sung '026 Do Not Render Obvious Claims 8-12

Dr. Shanfield's erroneous opinion that “Tsai discloses that all the diamond particles on the CMP pad dressers are cutters and share an equal dressing load when conditioning CMP pads” (Ex. 1002 at ¶ 189) is based on nothing more than his conjecture. The view that “all” superabrasive particles are working superabrasive particles that cut into a CMP pad finds no support in Tsai. As Dr. Shanfield has noted that “ODD can be leveled to less than 15 microns” in Tsai, there is no telling as to how many diamond grits are working superabrasive particles (as required in claims 8-11). That “ODD can be leveled to less than 15 microns” further demonstrates that Tsai does not disclose any diamond grits “protrude from the rigid

support substrate to distances within about 30 microns of one another” (as required in claim 12).

Nor can Dr. Shanfield’s opinion be derived from his own experience, as he has never measured the number of diamonds in a CMP pad conditioner (Ex. 2004 at 91:23-92:10) or even looked at a CMP pad conditioner in a scanning electron microscope (Ex. 2004 at 93:10-20). His testimony on this point should be disregarded for that reason alone.

Dr. Shanfield’s testimony is also unreliable because it lacks support from Tsai. Tsai teaches that its ODD has “has more cutters that can dress the pad,” (Ex. 1002 at 8:24-25) over a conventional CMP pad dresser but provides no indication of what a typical number of “cutters” in a conventional pad dresser would be, or how many more cutters are present on an ODD. (Ex. 2011 at ¶ 44.) Nor was the number of working diamonds even contemplated in the research underlying Tsai. (*Id.* at ¶ 44.) Accordingly, there is no basis, other than Dr. Shanfield’s assumption, untethered to any explicit disclosure, that a **plurality** of Tsai’s “diamond particles” are “cutters.” (Ex. 1002 at ¶¶ 180, 189.)

For the specific numbers of working superabrasive particles claimed in claims 8 [“at least 100 working superabrasive particles”], 9 [“at least 1000 working superabrasive particles”], 10 [“from about 1000 to 6000 working superabrasive particles”], 11 [“from about 2000 to about 5000 working superabrasive particles”],

and 12 [“at least about 1000 working superabrasive particles that protrude from the rigid support substrate to distances within about 30 microns of one another”], Dr. Shanfield relies on the same extrapolation from a single segment of Tsai’s ODD to a purported total number of “working superabrasive particles.” (Ex. 1002 at ¶¶ 186-89.) But just as this extrapolation is insufficient to establish the total number of diamond particles on Tsai’s ODD, it cannot be used to count the number of Tsai’s cutters, unless it is combined with Dr. Shanfield’s faulty assumption that “all” diamonds on Tsai’s ODD are “cutters.”

There is no explicit disclosure of any specific numbers of “cutters” on an ODD anywhere in Tsai, or of a plurality of cutters. (Ex. 2011 at ¶ 44.) For that reason alone, Tsai does not teach or suggest the “plurality of working superabrasive particles” of claims 6, 8, 9, 10, 11 and 12. Nor is the number of working diamonds even contemplated in the research underlying Tsai which analyzed how tip variation between diamond tips, as opposed to the number of diamonds, would impact cut rate on a CMP pad and quality of the wafer polished by that pad and reduce manufacturing costs of the conditioners. (*Id.* at ¶ 44.)

More importantly, at the time of Tsai, even one of skill in the art would not have been able to readily predict or otherwise determine, without substantial and extensive experimentation, the number or location of the superabrasive tips that would actually cut asperities into the CMP pad dresser during use. (*Id.* at ¶ 46.)

Rather, making such determinations would require substantial characterization of the usage conditions of the CMP pad dresser, including operating parameters and the characteristics of the CMP pad itself. (*Id.* at ¶ 46.) It would require substantial and extensive experimentation, which would involve detailed surface measurements of CMP pad dressers post-manufacture and post-use, along with examination of various types of CMP pads on which they were used. (*Id.* at ¶ 46.)

This difficulty in determining which superabrasive particles actually performed cutting only increases as the variation in tip height became more tightly controlled. (*Id.* at ¶ 47.) That is because extreme outlying superabrasive particles would be most likely to actually cut asperities, and so such particles are more likely to perform the cutting, and so reducing the variance in outlying parties correspondingly reduces the ability to predict which particles will cut. (*Id.* at ¶ 47.)

Dr. Shanfield’s alternative argument that “each superabrasive particle is itself cutting asperities in the CMP pad and is a working superabrasive particle” in Sung ’026 (Ex. 1002 at ¶ 191) is similarly infirm and contradicted by Sung ’026’s teaching that its superabrasive particles include particles that “will be ***recessed in height*** as compared to superabrasive particles having tips and edges oriented towards the adhesive, and ***thus will not contact the CMP pad during dressing.***” (Ex. 1005 at [0080].)

Sung '026's teaching of "uniform distribution of frictional force" (*id.* at [0051]) does not dictate that all particles must be working particles. In fact, Dr. Shanfield's view that diamond particles that experience frictional forces are by definition working particles that cut a CMP pad reflects an understanding of how a pad conditioner works that had been superseded by 2012. (Ex. 2011 at ¶ 52.) Prior to 2012, it was widely assumed that mechanical stresses would be substantially equally distributed among the bulk of superabrasive particles during use of CMP pad dressers. (*Id.* at ¶ 52.) That view has now given way to empirical data showing that it is the outlying superabrasive particles that provide the greatest contribution to the behavior of the CMP pad dresser in operation. (*Id.* at ¶ 53.) And likewise, the orientation of superabrasive particles also impacts which particles cut the pad. (*Id.* at ¶ 53.)

This is particularly true since there are tens of thousands of diamonds on the ODD. To determine the spacing between each such diamond would be extremely labor intensive, and no imaging technology at the relevant time would have allowed such determination to be performed accurately because doing so would require perfect image alignment among thousands of images, which must first be taken. (*Id.* at ¶ 55.) And even then, a POSITA at that time would not be able to determine which of those particles were "working superabrasive particles." (*Id.* at ¶ 55.) . This is also because even distribution of frictional forces across the conditioner could

also be achieved by diamond particles that are randomly distributed on a conditioner as such frictional forces can be tightly controlled by tip leveling. (*Id.* at ¶ XX.)

Similarly, Sung 026’s disclosure that “[t]he protruding superabrasive particles 12 *can* cut into the CMP pad to a depth that is essentially the distance of the protrusion” does not dictate that all particles of all protrusion depths actually do cut into the CMP pad.

VI. SUNG ’146 AND SUNG ’026 DO NOT RENDER OBVIOUS CLAIMS 1-7 AND 13-21

A. Sung ’146 Is Not Prior Art to Claims 1-3, 6-7, or 16-18 Because Sung ’026 Is Also the Grandparent of the ’802 Patent

Like Sung ’026, Sung ’146, which issued as USP No. 8,974,270, is not prior art to the ’802 Patent because Sung ’146 is the *grandparent* of the ’802 Patent and to which the ’802 Patent claims priority. Petitioners’ invalidity based on Sung ’026 and Sung ’146 for claims 1-7 and 13-21 rises and falls entirely on their argument that Dr. Sung has purportedly disclaimed any priority date earlier than the filing date of the ’802 Patent on October 3, 2014. However, as detailed at length in Section III above, Dr. Sung did not disclaim, nor could he have disclaimed, the subject matter of his earlier applications. Instead, Petitioners’ argument rests on a skewed misreading and intentional mischaracterization of Dr. Sung’ declaration. Accordingly, neither Sung ’146 nor Sung ’026 is prior art to claims 1-7 and 13-21 and cannot render those claims obvious.

VII. CONCLUSION

For all the reasons stated above, Patent Owner respectfully requests that the Board reject all three grounds of unpatentability in the Petition and find that all of the challenged claims of the '802 Patent are patentable in light of the references asserted by Petitioner.

Dated: December 11, 2024

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that there are 13,021 words in this paper, excluding any table of contents, table of authorities, mandatory notices under 37 C.F.R. § 42.8, certificate of word count, certificate of service, or appendix of exhibits. This certification relies on the word count of the word-processing system used to prepare this paper.

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on December 11, 2024, the foregoing document is being served via electronic mail upon the following counsel of record for Petitioner:

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