

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

Case IPR2024-00533

PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,974,270
CHALLENGING CLAIMS 1-8
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104

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PETITIONER’S EXHIBIT LIST

Petitioner Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 8,974,270 (“’270 Patent”)
1002	Declaration of Dr. Stanley Shanfield
1003	File History of the ’270 Patent
1004	U.S. Patent Application Publication No. 2010/0022174 (“Chou”)
1005	U.S. Patent Application Publication No. 2008/0096479 (“Sung’479”)
1006	U.S. Patent Application Publication No. 2008/0004743 (“Goers”)
1007	Sung et al. “Polycrystalline Diamond (PCD) Shaving Dresser: The Ultimate Diamond Disk (UDD) for CMP Pad Conditioning,” <i>ECS Transactions</i> , 18 (1) 523-528 (2009) (“SungECS”)
1008	U.S. Patent No. 5,036,015
1009	Ishizuka et al. “PCD Dressers for Chemical Mechanical Planarization with Uniform Polishing” Proceedings of International Conference on Leading Edge Manufacturing in 21 st Century: LEM21, 2007, Volume 2007.4
1010	U.S. Patent Application Publication No. 2003/0084894
1011	U.S. Patent No. 7,741,764
1012	Scheduling Order in <i>Sung v. Samsung Electronics Co., Ltd. et al</i> , 4-23-cv-00752
1013	Tsai et al., “Effect of CMP conditioner diamond shape on pad topography and oxide wafer performances,” <i>Int. J. Adv. Manuf. Technology</i> , 55: 253-262 (2011)
1014	Fenna, Donald. “Hardness Numbers,” <i>A Dictionary of Weights, Measures, and Units</i> , 1st ed., Oxford University Press, 2004.
1015	A copy of SungECS obtain from CCC RightFind
1016	Proceedings of <i>ISTC/CSTIC 2009</i> , published by the Electrochemical Society, obtained from the Electrochemical Society
1017	WorldCat record for <i>ISTC/CSTIC 2009</i> , available at https://search.worldcat.org/title/426038995 ; Bibliographic and MARC records for the electronic version of <i>ISTC/CSTIC 2009</i> , available at http://merlin.lib.umsystem.edu/record=b7054493~S1 from the online catalog of the library of the University of Missouri, Columbia; and OCLC FirstSearch record for <i>ISTC/CSTIC 2009</i> (subscription required for access)

Petition for *Inter Partes* Review of U.S. Patent No. 8,974,270
Claims 1-8

Petitioner Exhibit No.	DESCRIPTION
1018	MERLIN, Missouri Education and Research Libraries Information Network, The catalogs of the libraries of the University of Missouri system, archived on January 12, 2011, by Internet Archive, available at https://web.archive.org/web/20110112054807/http://laurel.lso.missouri.edu/
1019	Declaration of Dr. Ingrid Hsieh-Yee
1020	EDTX Caseload Profile (December 31, 2023)

Petition for *Inter Partes* Review of U.S. Patent No. 8,974,270
Claims 1-8

Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC, collectively the “Petitioner,” requests *inter partes* review of claims 1-8 of U.S. Patent No. 8,974,270 (the “’270 Patent”) (EX1001).

I. Mandatory Notices

A. Real Parties-In-Interest

Petitioner identifies itself as a real party-in-interest (“RPI”).

B. Related Matters

Petitioner is concurrently filing petitions for *inter partes* review of U.S. Patent Nos. 9,138,862 and 9,724,802. The ’270 Patent is currently asserted against Petitioner by Patent Owner in *Sung v. Samsung Electronics Co., et al.*, No. 4:23-cv-752 (EDTX).

C. Counsel

Petitioner is filing a Power of Attorney appointing the practitioners associated with Customer Number 132,593. Petitioner designates the following lead and back-up counsels:

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II. Fees

Petitioner is concurrently electronically submitting the required fees for this Petition. The Board is authorized to charge Desmarais LLP's deposit account, No. 50-6822, for any fee deficiency.

III. Certification Of Grounds For Standing

Petitioner certifies that the '270 Patent is available for *inter partes* review and that Petitioner is not estopped or barred from requesting this *inter partes* review.

IV. Identification Of Challenge And Relief Requested

Petitioner requests *inter partes* review and cancellation of claims 1-8 of the '270 Patent.

A. Identification Of Prior Art

The following references are pertinent to the grounds of unpatentability explained below:

1. U.S. Patent Application Publication No. 2010/0022174 (“Chou”) (EX1004), published on January 28, 2010, is prior art under 35 U.S.C. §102(b).¹
2. U.S. Patent Application Publication No. 2008/0096479 (“Sung’479”) (EX1005), published on April 24, 2008, is prior art under 35 U.S.C. §102(b).
3. U.S. Patent Application Publication No. 2008/0004743 (“Goers”) (EX1006), published on January 3, 2008, is prior art under 35 U.S.C. §102(b).
4. Sung et al. “Polycrystalline Diamond (PCD) Shaving Dresser: The Ultimate Diamond Disk (UDD) for CMP Pad Conditioning,” *ECS Transactions*, 18

¹ The actual filing date of the '270 Patent is May 23, 2012. This Petition applies the pre-AIA provisions of 35 U.S.C. §§ 102 and 103.

(1) 523-528 (2009) (“SungECS”) (EX1007), published on March 6, 2009, is prior art under 35 U.S.C. §102(b).

i. Public Accessibility of SungECS

SungECS was first published on March 6, 2009. The header of SungECS lists the year 2009. *See* EX1007; *see also* EX1015, p.1 (showing a publication date of March 6, 2009) and EX1016, p.2 (showing a 2009 copyright date, and demonstrating that the publisher is the copyright holder); *see also* EX1019, ¶¶35-42. These markers support that SungECS was published in 2009. Indeed, “the indicia on the face of a reference, such as printed dates and stamps, are considered as part of the totality of the evidence.” *Hulu, LLC, v. Sound View Innovations, Inc.*, IPR2018-01039, Paper 29, at 17-18 (precedential). Additionally, *ECS Transactions* is a well-known, established, and widely distributed scientific journal and therefore is presumptively publicly accessible. *See Sun Pharm. Indus. LTD v. Aurinia Pharm. Inc.*, IPR2022-00617, Paper 9 at 23 (“When there is an established publisher there is a presumption of public accessibility as of the publication date.”).

Furthermore, as Dr. Ingrid Hsieh-Yee declares, the Library of the University of Missouri, Columbia, created a catalog record of *ISTC/CSTIC 2009* that contains SungECS as of July 16, 2009, making this publication discoverable in their online catalog. Specifically, Dr. Hsieh-Yee provides an archived copy of the website

MERLIN,² which is the shared online catalog. As Dr. Hsieh-Yee shows in EX1018, MERLIN provided a single search box for users to explore library collections, which would have allowed a POSITA to search for works by keyword, title, author, subject, and several other data elements. Additionally, Dr. Hsieh-Yee attests that the Library of University of Missouri, Columbia entered the record for the conference proceedings containing SungECS into the WorldCat database on OCLC. Therefore, as of July 16, 2009, the record became discoverable on WorldCat, the free web portal for the general public to explore library collections worldwide. The record also became discoverable on the same date in the OCLC FirstSearch system, which is available to subscribers as a research tool. EX1019, ¶¶45-57.

For at least these reasons, SungECS was “disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, [could] locate it” more than a year before the claimed priority date of the ’270 Patent. *In re Wyer*, 655 F.2d 221, 210 (CCPA 1981); MPEP §2128.I.

² Missouri Education and Research Libraries Information Network

B. Statutory Grounds Of Unpatentability

Petitioner requests cancellation of claims 1-8 of the '270 Patent under 35 U.S.C. § 103³ based on the following Grounds.

Ground	35 U.S.C.	Claims	Prior Art References Relied Upon
I	§103	1, 3-8	Chou with Sung'479
II	§103	6-7	Chou with Sung'479 and SungECS
III	§103	2	Chou with Sung'479 and Goers

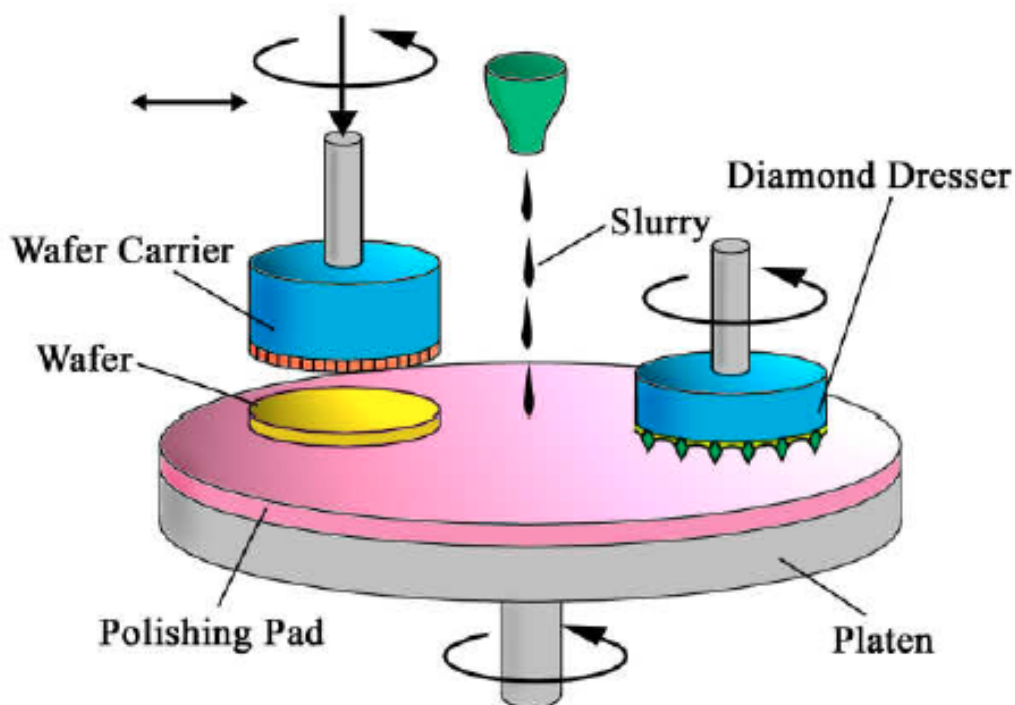
This Petition demonstrates that there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. *See* 35 U.S.C. § 314(a).

V. Technology Background

A. Chemical Mechanical Planarization (CMP)

Chemical mechanical planarization ("CMP") is a process that has been used in semiconductor manufacturing since the 1990s to make semiconductor wafer surfaces planar. As the name implies, CMP includes both a chemical and a mechanical aspect. As shown below, a chemical slurry is applied to a CMP pad ("polishing pad") as the semiconductor wafer is mechanically pressed onto a rotating CMP pad to planarize the semiconductor wafer.

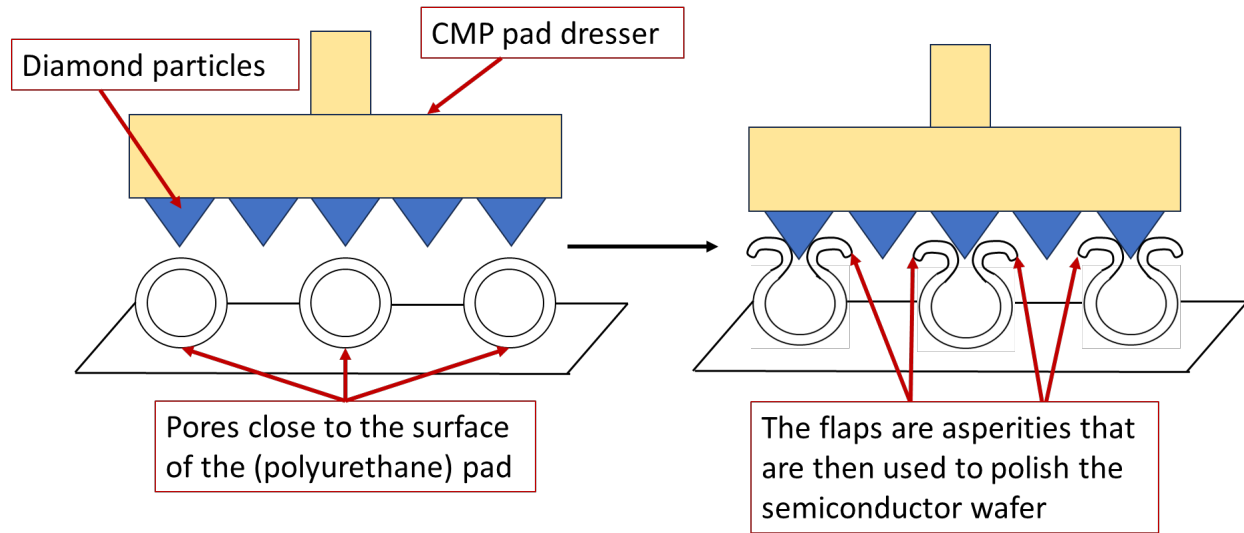
³ Petitioner reserves the right to challenge the patentability of the claims under 35 U.S.C. §112 in other proceedings.



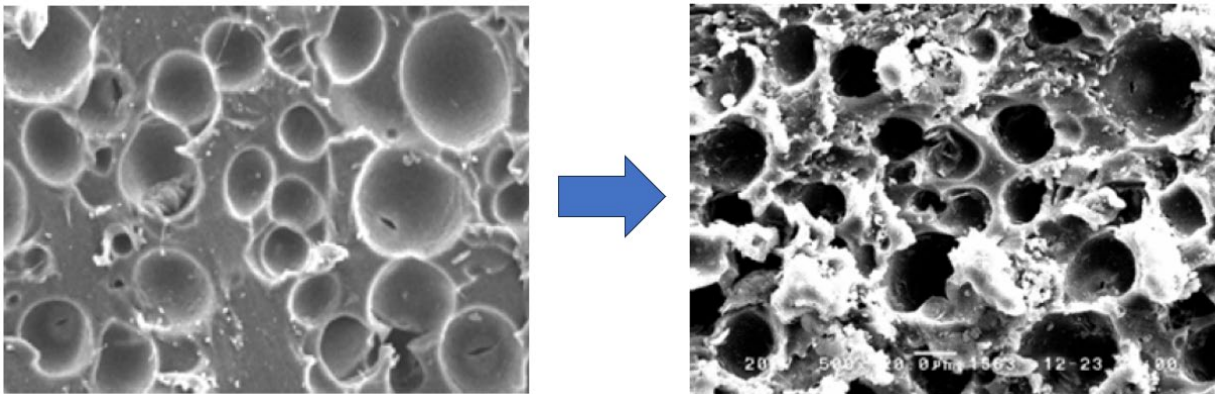
EX1009, Fig. 2. *See also id.*, 1:17-28, EX1008, 1:13-48. The rotating polishing pad is typically made of a soft polymeric material, such as polyurethane. EX1008, 1:44-46, EX1009, 1:17-18. The polishing pad contains micron-sized asperities that can hold the slurry and polish the wafer. However, during use, the pad's polishing performance decreases as the asperities become dulled, and the pad must be reconditioned to regenerate the asperities for optimal performance. EX1005, [0004]. EX1002, ¶¶37-39.

A CMP pad dresser (labeled above as “diamond dresser” and also often called a “pad conditioner”) is used to “revive” the pad surface by “combing” or “cutting” the surface of the CMP pads using superabrasive particles, such as diamond

particles. EX1010, [0026]. The diamond particles protruding from the dresser's substrate cut into the CMP pad and generate new asperities. EX1002, ¶40.



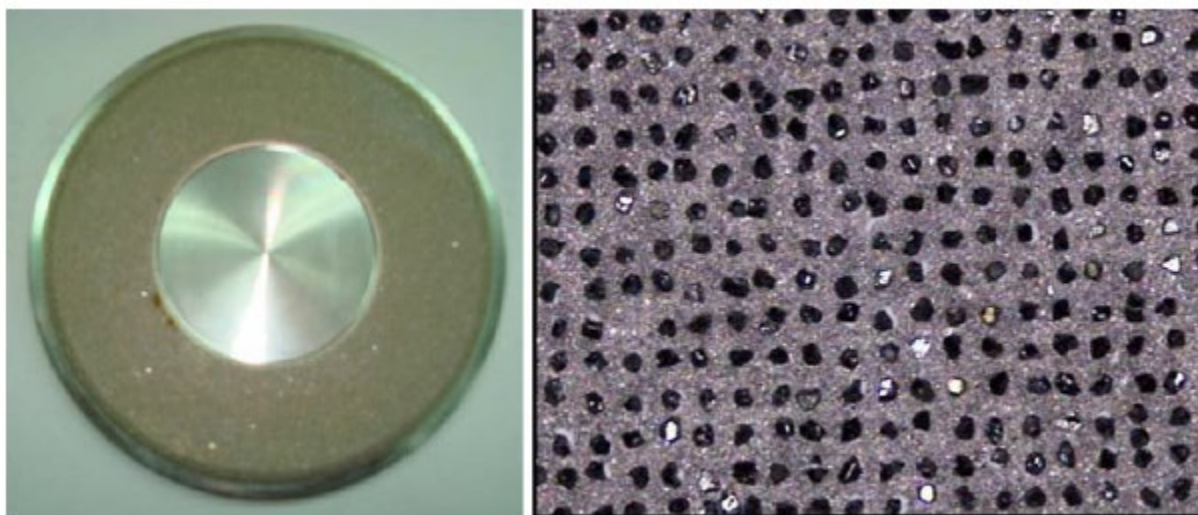
For example, microscope images of a new CMP pad (left) and one that has been conditioned for 20 hours by a CMP pad dresser (right) are shown below.



EX1013, Figure 14. EX1002, ¶41.

A typical CMP pad dresser is shown below. As shown, the diamond particles are arranged over a portion of a circular disk. In this particular example, the diamond spacing is about 500 μm distributed over a portion of a 108 mm diameter disk (non-

shiny portion), providing approximately 12,000 diamond particles. See EX1013, 255 (“The conventional diamond pad conditioner used—a DiaGrid (DG) disk (Kinik, Taiwan)—contained single-crystal diamond grits (120 μm). The diameter of the DG disk was 108 mm, with a diamond spacing (cutting pitch) of 500 μm and a single type of diamond grits across the entire disk, as shown in Fig. 3”), 258 (“DG contained approximately 12,000 diamond grits...”).



EX1013, Figure 3 (“Appearance of conventional diamond disk”). EX1002, ¶¶42-44.

When fabricating the dressers, superabrasive particles are often secured onto the surface of the dresser using a process called “brazing.” Brazing involves applying a heated metal alloy that chemically bonds to both the superabrasive particles and the underlying substrate. EX1010, [0077]-[0078]. Various techniques to achieve a uniform protrusion of the diamond particles over the entire substrate

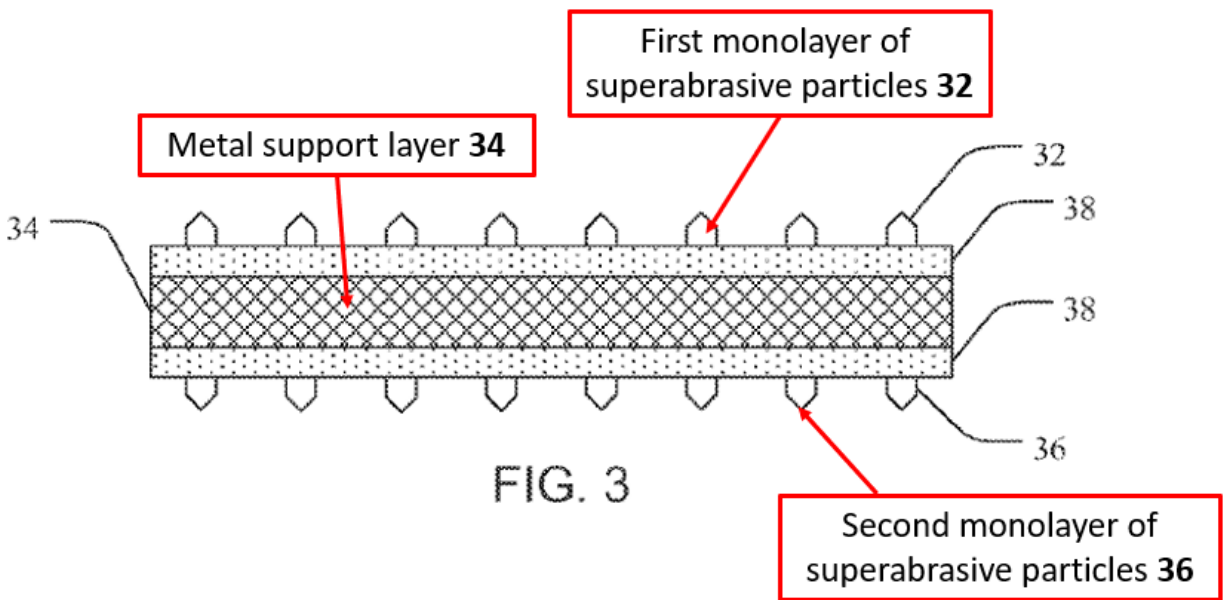
surface and reduce the substrate's warpage during the brazing process have been developed in the art. EX1004, [0009] (describing distributing the abrasive particles on the top and bottom surfaces of the substrate to reduce the warpage caused by the difference in shrinkage between the two surfaces); EX1005, [0050] (describing the use of low-melting point braze materials to reduce warpage and level the tip heights). EX1002, ¶¶45-46.

VI. Overview Of The '270 Patent

A. Purported Invention Of The '270 Patent

The '270 Patent is directed to abrasive tools having superabrasive particles. *See* EX1001, Abstract. In particular, the '270 Patent notes that superabrasive tools, such as CMP pad dressers, should be substantially flat and free of warpage to polish the CMP pads effectively. *See* EX1001, 6:55-7:7. EX1002, ¶48.

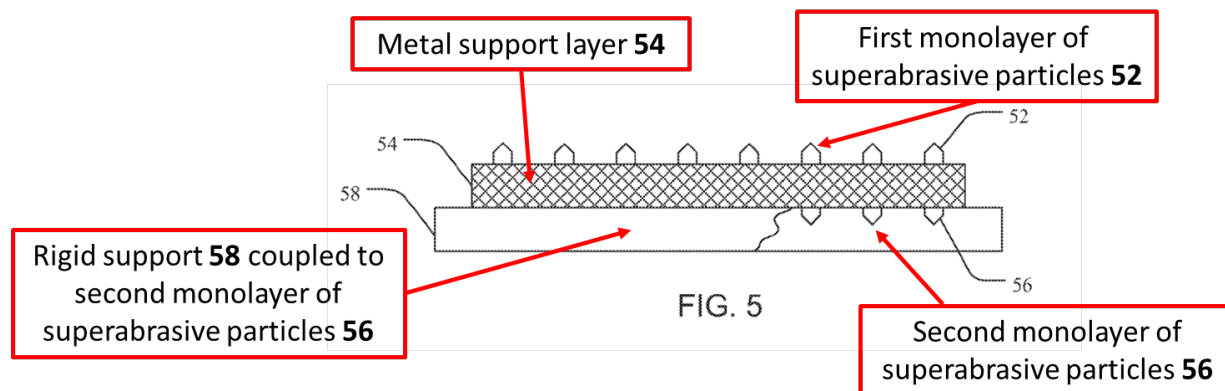
As shown below in Figure 3, the '270 Patent discloses a first and second monolayer of superabrasive particles 32 and 36 secured on both sides of a metal support layer 34 using a bonding material 38 to address problems with warpage by creating "symmetrical forces" on the two opposite sides of the metal support layer during brazing. *See* EX1001, 2:11-26, 11:39-51.



EX1001, FIG. 3 (annotated). EX1002, ¶49.

In addition, the '270 Patent specifies that the protrusion height difference between the highest and the second highest protruding tip (claims 1, 5, and 8), the highest protruding tip and the 10th highest protruding tip (claim 6), and the highest protruding tip and the 100th highest protruding tip (claim 7) be within a specific range (e.g., less than or equal to 10, 20, 40, or 50 μm). See EX1001, claims 1 and 5-8. EX1002, ¶49.

Finally, the '270 Patent describes a rigid support 58 coupled to the second monolayer of superabrasive particles 56. See EX1001, 13:9-10.



EX1001, FIG. 5 (annotated). EX1002, ¶50.

B. Prosecution History Of The '270 Patent

The application for the '270 Patent, which included original claims 1-27, was filed on May 23, 2012, claiming priority to U.S. Provisional Application No. 61/489,074. *See* EX1001, Cover; EX1003, 1.

On May 15, 2014, the Examiner issued a Non-Final Office Action rejecting claims 1-9 and 24 under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner also rejected claims 1-9, 14-15, 20, and 25-27 under 35 U.S.C. §§102 and 103 based on the following references: Dinh-Ngoc (US2010/0248595), Goers'553 (US 7,198,553), and Telesin (US 5,380,390)—none of which are relied upon in this instant Petition. In addition, the Examiner issued a non-statutory obviousness-type double patenting rejection for claims 10, 14-23, and 25-26 in view of claims 1, 12-18, and 20-21 of co-pending application 13/239,198, which later issued as U.S. 8,777,699 ("the '699 Patent). *See* EX1003, 204-216.

In response, the Applicant canceled claims 1-6 and 14-27. Applicant

additionally amended claim 10 (issued as claim 1) by adding the portions in underline below table and amended claims 7-9 to depend from claim 10. The Applicant also added a new claim 28 depending from claim 10. *See* EX1003, 1027-1032.

Furthermore, the Applicant filed a Terminal disclaimer over co-pending application 13/239,198 to overcome the obviousness-type double-patenting rejection. *See* EX1003, 1039.

The table below sets forth independent claim 1 of the '270 Patent and claim 1 of the '699 Patent, with the differences highlighted using bolded italics.

Claim 1 of the '270 Patent	Claim 1 of the '699 Patent
A CMP pad dresser, comprising:	A CMP pad dresser, comprising:
a first monolayer of superabrasive particles disposed on <u>and <i>protruding from</i></u> one side of a metal support layer,	a first monolayer of superabrasive particles disposed on and <i>coupled to</i> one side of a metal support layer; and
<i><u>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;</u></i>	
a second monolayer of superabrasive particles disposed on the metal support	a second monolayer of superabrasive particles disposed on <i>and coupled to</i> the

Claim 1 of the '270 Patent	Claim 1 of the '699 Patent
layer on an opposite side from the first monolayer,	metal support layer on an opposite side from the first monolayer,
wherein the superabrasive particles of the second monolayer are positioned to have substantially the same distribution as the superabrasive particles of the first monolayer; and	wherein the superabrasive particles of the second monolayer are positioned to have substantially the same distribution as the superabrasive particles of the first monolayer; and <i>further comprising</i>
a rigid support coupled to the second monolayer of superabrasive particles opposite the first monolayer.	A rigid support coupled to the second monolayer of superabrasive particles opposite the first monolayer.

Thereafter, the Examiner issued a Notice of Allowance on January 12, 2015, and the patent issued on July 15, 2015. EX1003, 1042-1046; EX1001, Cover.

VII. Summary of IPR2014-01523 Against U.S. Patent No. 8,777,699

Kinik challenged the patentability of U.S. Patent No. 8,777,699 (the “’699 Patent”) in IPR2014-01523 and the Board found claims 1-12 and 17-19 of the ’699 Patent to be unpatentable. *See Kinik Co. v. Chien-Min Sung*, IPR2014-01523 (“’699 Kinik IPR”), Paper 26 (“’699 Kinik IPR FWD”). Specifically, the Board found on November 4, 2015 that “claims 1-3, 5, 6, 8-12, and 17-19 [of the ’699 Patent] are

anticipated by Chou.”⁴ *Id.*, 23.

The instant Petition relies on Chou for the limitations that are substantially identical to claim 1 of the ’699 Patent.

VIII. Overview Of Chou And Sung’479

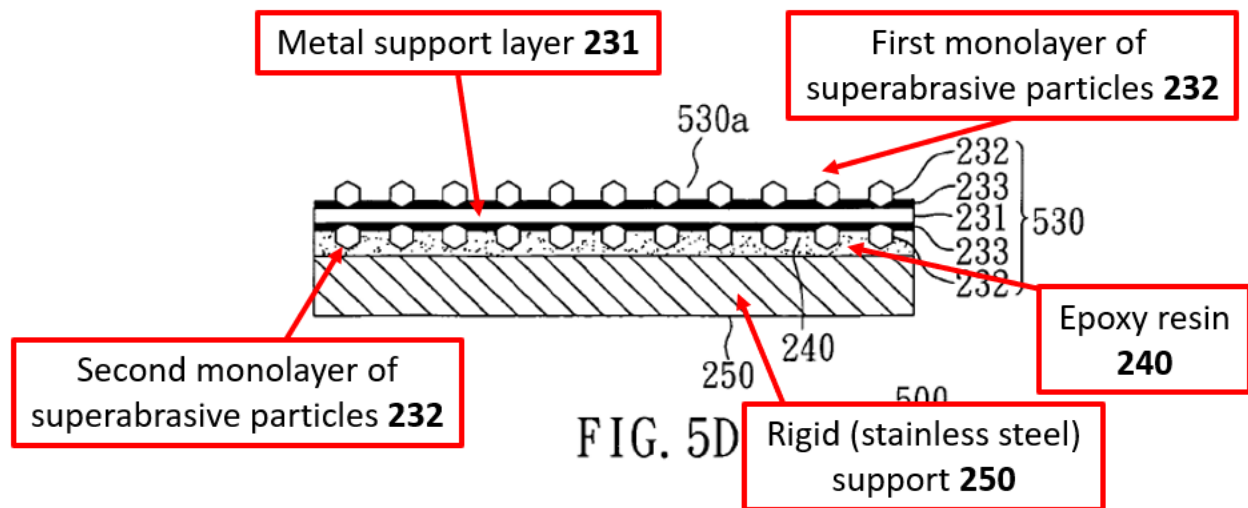
A. Chou

Chou is directed to abrasive tools having abrasive diamond particles. *See* EX1004, [0009] (“The grinding plate according to the present invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”), [0058] (“The material of the soft substrate 231 is a metal, and the abrasive particles 232 are diamond particles...”). Chou notes that the abrasive tool should be substantially flat and free of warpage. EX1004, [0004]-[0005] (“Grinding and polishing are ultra-precision machining technologies with the ability to make the surface of a workpiece have acceptable smoothness and flatness. ... Thereby, it is an important issue to develop various grinding tools that can meet process requirements.”). EX1002, ¶¶66-69.

As shown below, Chou places a first and second monolayer of superabrasive

⁴ Sung never appealed the unpatentability findings to the Federal Circuit, and the deadline to appeal the decision has long passed.

particles 232 on a metal support layer 231 by brazing. *See* EX1004, [0031] (“Herein, the grinding plate 230 comprises ... a plurality of abrasive particles 232 formed on the working surface 231a of the soft substrate 231 by brazing.”), [0051] (“The material of the soft substrate 231 is a metal.”). Specifically, Chou places the monolayer of superabrasive particles 232 on both sides of a metal support layer 231 to minimize the deformation due to the difference of shrinkage between the two surfaces, *i.e.*, warping. EX1004, [0054] (“In the present embodiment, the deformation resulting from the difference of shrinkage between the two surfaces of the soft substrate can be inhibited since both surfaces of the soft substrate 231 have abrasive particles 232 and a combining layer 233 thereon.”), [0009].



EX1004, FIG. 5D (annotated). EX1002, ¶¶68-69.

Additionally, as shown above, a rigid stainless steel support 250 is coupled to the second monolayer of superabrasive particles 232 using an epoxy resin 240.

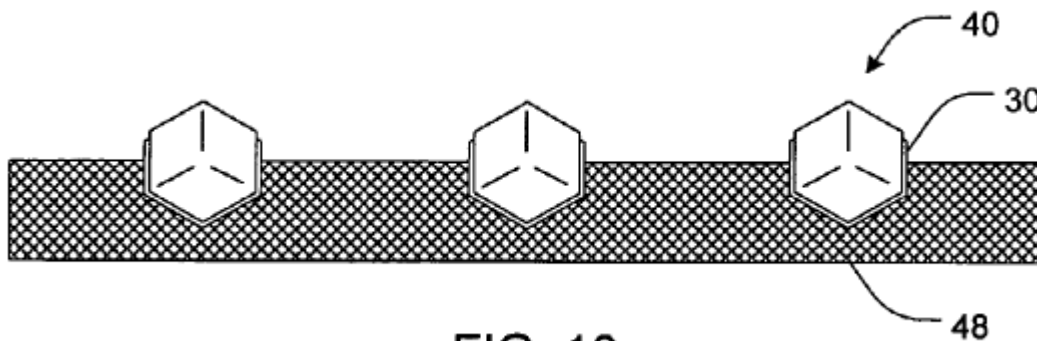
EX1004, [0056] (“Then, a backplane 250 is disposed on the surface of the adhesive layer 240, and the adhesive layer 240 is cured by a heating process so as to retain the backplane 250 on the non-working surface of the grinding plate 530.”). EX1002, ¶70.

Chou explains that the method can precisely control the height of the abrasive particles, allowing each of the abrasive particles to efficiently participate in machining, thereby enhancing the precision of the grinding tool. EX1004, [0024] (“Accordingly, by the method for fabricating a grinding tool according to the present invention, the height of the abrasive particles can be precisely controlled, and thereby each of the abrasive particles can efficiently perform machining so as to enhance the machining efficiency and precision of the grinding tool.”), [0017], [0032], [0037], [0052]. EX1002, ¶71.

B. Sung’479

Sung’479 is directed to superabrasive tools with diamond particles, such as CMP pad conditioners. EX1005, [0009] (“Accordingly, the present invention provides superabrasive tools and methods that are, without limitation, suitable to groom the CMP pads used for the delicate polishing applications as recited above.”), [0004], [0055] (“In one aspect, the superabrasive particle may be diamond...”). In particular, Sung’479 discloses that there is a need for CMP pad dressers that have precise leveling of particle tip heights in order to achieve uniform asperity depth.

See EX1005, [0005]-[0006]. Accordingly, Sung'479 discloses superabrasive tools made using low-melting point braze to reduce the warpage of the tool, thereby enabling better leveling of the superabrasive particles. EX1005, [0050] (“[S]uperabrasive tools that are constructed with traditional molten braze materials are necessarily made at high temperatures that often warp the tool. Such warpage causes movements in the relative positions of the superabrasive particles as the tool cools. It is thus very difficult to obtain precise leveling of the tips of superabrasive particles in such tools for applications requiring very precise polishing. It has now been found that the variance between the tip heights of a plurality of superabrasive particles in a tool can be greatly reduced by utilizing a braze having a low-melting point to bond the superabrasive particles.”).



EX1005, FIG. 10. EX1002, ¶¶73-76.

Specifically, Sung'479 explains that the “superabrasive particles are arranged such that their tips vary from the designated profile by less than about 10 microns ... less than about 5 microns ... [and even] less than about 1 microns.” EX1005,

[0072]. EX1002, ¶77.

IX. Level Of Ordinary Skill In The Art

A person having ordinary skill in the art (“POSITA”) would have had, as of the earliest claimed priority date of May 23, 2011, a bachelor’s degree in an engineering related field, such as material science, mechanical engineering, electrical engineering, or physics, and a minimum of two to three years of experience in the field of integrated circuit processing and fabrication techniques. A higher level of education or specific skill might make up for less experience, and vice versa. EX1002, ¶63.

X. Claim Construction

The claims should be construed “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). The Patent Owner can act as his own lexicographer. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (holding that an inventor may define specific terms used to describe the invention). Moreover, the Board “need[s] only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor, Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g*, 200 F.3d 795, 803 (Fed. Cir.

1999)).⁵ While the Board may not need to construe the following terms for the purposes of this instant IPR proceeding, Patent Owner has acted as his own lexicographer for the following terms in the '270 Patent.

A. “superabrasive”

Claims 1-8 recite “superabrasive.” The '270 Patent notes that “[a]s used herein, ‘superabrasive’ may be used to refer to any crystalline, or polycrystalline material, or mixture of such materials which has a Moh[']s hardness of about 8 or greater.” EX1001, 4:9-11. Some examples of “[s]uch materials include ... diamond, polycrystalline diamond (PCD), ... as well as other superabrasive materials known to those skilled in the art.” EX1001, 4:13-17. EX1002, ¶81.

B. “protrusion”

Claims 1 and 5-8 recite “protrusion.” The '270 Patent notes that “for the purposes of the present disclosure, the term ‘protrusion’ refers to the height of a particle relative to some reference point.” EX1001, 8:13-15. EX1002, ¶82.

C. “sharp portion”

Claim 3 recites “sharp portion.” The '270 Patent notes that “[a]s used herein, ‘sharp portion’ means any narrow portion to which a crystal or particle may come,

⁵ Petitioner reserves the right to raise other/additional claim construction arguments in any other/parallel proceedings.

including but not limited to corners, apexes, ridges, edges, obelisks, and other protrusions.” EX1001, 4:55-58. EX1002, ¶83.

D. “attitude”

Claims 3 and 4 recite “attitude.” The ’270 Patent notes that “[a]s used herein, ‘attitude’ means the position or arrangement of a superabrasive particle in relation to a defined surface, such as a substrate to which it is attached, or a CMP pad to which it is to be applied during a work operation.” EX1001, 5:21-24. EX1002, ¶84.

XI. Specific Grounds For Challenge

The sections below, as supported by Dr. Shanfield’s Declaration, demonstrate how the claims are unpatentable. 37 C.F.R. 42.104(b)(4)-(5). EX1002, ¶36.

A. Ground I: Chou With Sung’479 Render Obvious Claims 1 And 3-8

1. Ground I: Independent Claim 1

i. [1Pre] A CMP pad dresser, comprising

The term “CMP pad dresser” in the preamble is not limiting. For example, in the earlier ’699 Kinik IPR, the Board found that the preamble “CMP pad dresser” is not limiting. *See* IPR2014-01523, Paper 26, 6-11 (“Accordingly, in summary, we do not construe as limiting the recitation of ‘CMP pad dresser’ limits independent claims 1 and 11.”). Claim 1 of the ’270 Patent is nearly identical to claim 1 of the ’699 Patent, except that claim 1 of the ’270 Patent adds limitation [1B]. As such, just as the Board held in the ’699 Kinik IPR, the body of claim 1 of the ’270 Patent

is structurally complete “such that deletion of the preamble phrase does not affect the structure.” *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 809 (Fed. Cir. 20220). EX1002, ¶88-89.

Even if the preamble were limiting, the Board previously found that Chou teaches the claimed CMP pad dresser. *See* IPR2014-01523, Paper 26 (’699 Kinik IPR FWD), 17 (“As set forth above, we are unpersuaded that the recitation of ‘CMP pad dresser’ in the preambles are limiting, and even if they were, we are persuaded that at least some of the grinding or polishing tools disclosed in Chou could be used as CMP pad dressers.”).⁶ EX1002, ¶90.

Indeed, Chou teaches grinding or polishing tools that a POSITA would have recognized to be used as a CMP pad dresser. *See* EX1004, [0004] (“Grinding and polishing are ultra-precision machining technologies with the ability to make the surface of a workpiece have acceptable smoothness and flatness.”), [0007] (“An object of the present invention is to provide a grinding tool...”), [0008]. Chou further teaches that grinding tools have abrasive particles distributed over the working surface. *See* EX1004, [0009] (“The grinding plate according to the present

⁶ In view of the ’699 Kinik IPR FWD, Patent Owner is collaterally estopped from advancing the argument that Chou does not disclose a “CMP pad dresser.” *See* Section XII [Collateral Estoppel].

invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”). Hence, Chou teaches a CMP pad dresser. EX1002, ¶¶91.

Even further yet, the instant petition relies on the combination of Chou and Sung’479, and Sung’479 teaches that one particular form of a grinding or polishing pad tool is a CMP pad dresser. *See* EX1005, claim 38 (“The superabrasive tool of claim 29, wherein the superabrasive tool is a polishing or grinding pad.”), claim 39 (“The superabrasive tool of claim 29, wherein the superabrasive tool is a CMP pad dresser.”). Hence, at a minimum, Chou and Sung’479 render obvious a “CMP pad dresser.” EX1002, ¶¶87, 92.

ii. [1A] a first monolayer of superabrasive particles disposed on and protruding from one side of a metal support layer

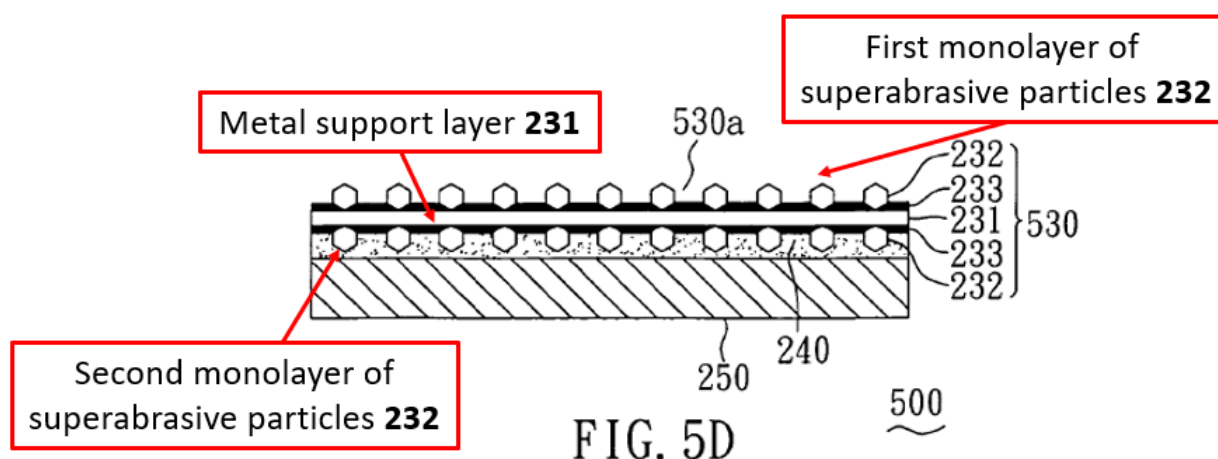
At the outset, as discussed in Section X [Claim Construction], the ’270 Patent notes that “[a]s used herein, ‘superabrasive’ may be used to refer to any crystalline or polycrystalline material or mixture of such materials which has a Moh[s] hardness of about 8.0 or greater.” Even assuming this is a lexicographic definition that must be applied, Chou discloses limitation [1A]. EX1002, ¶94.

First, Chou discloses a CMP pad dresser with a layer of particles 232, which are diamond particles and therefore have a Mohs hardness of about 8.0 or greater. EX1004, [0009], [0022] (“The abrasive particles can be any material with high

hardness, ... Preferably, the abrasive particles are diamond particles.”), [0058] (“The material of the soft substrate 231 is a metal, and the abrasive particles 232 are diamond particles...”); *see also* EX1001, 8:59-65 (explaining that “the superabrasive particles include diamond materials”); EX1014 (showing a Mohs hardness of 10 for diamond). Accordingly, Chou teaches the superabrasive particles of [1A]. EX1002, ¶100.

Second, Chou discloses a substrate 231 that can be made of metal and meets the claimed “metal support layer.” EX1004, [0051] (“The material of the soft substrate 231 is a metal...”). EX1002, ¶96.

Third, Chou discloses a monolayer of superabrasive particles disposed on one side of a metal support layer. For example, as shown in Figure 5D below, a single layer of particles 232 is disposed on the side of the working surface 530a of the metal substrate 231. *See* EX1004, [0009] (“The grinding plate according to the present invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”), [0038]-[0044], [0054]-[0058]. And because the first monolayer of superabrasive particles 232 is illustrated as a single layer, it meets the claimed “monolayer.” *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (holding that drawings and pictures can anticipate claims if they clearly show the structure which is claimed).



EX1004, Fig. 5D (annotated); *see also id.* Figures 3A-3D, 5A-5C. *See also* IPR2014-01523, Paper 26, 16 (acknowledging Kinik’s reliance on “working surface 530a” as meeting this limitation). EX1002, ¶¶97-98.

Finally, the first monolayer of particles 232 is protruding from the working surface 530a side of the metal substrate 231, having a height relative to a reference point (*e.g.*, top of combining layer 233 or top of substrate 231). *See* EX1004, [0009] (“The grinding plate according to the present invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”), [0038]-[0044], [0054]-[0057], [0059], Figures 3A-3D, 5A-5D. EX1002, ¶99.

To the extent Patent Owner argues that Chou does not disclose a monolayer of superabrasive particles disposed on one side of a metal support layer, Sung’479 renders obvious this portion of limitation [1B]. For example, Sung’479 notes that “[v]arious reverse casting methods may be utilized to manufacture the superabrasive

tools and particularly the CMP pad dressers...” EX1005, [0082]. The reverse casting process is described with respect to Figures 7-10. As shown in Figure 7, “superabrasive particles 30 may be disposed at least partially into the spacer layer 32, such that they protrude at least partially from the spacer layer 32.” EX1005, [0082]. Then, as shown in Figure 8, a low-melting point braze 38 is applied. *See* EX1005, [0085]. Finally, as shown in Figures 9-10, the spacer layer 32 is removed to obtain a monolayer of superabrasive particles. *See* EX1005, [0086].

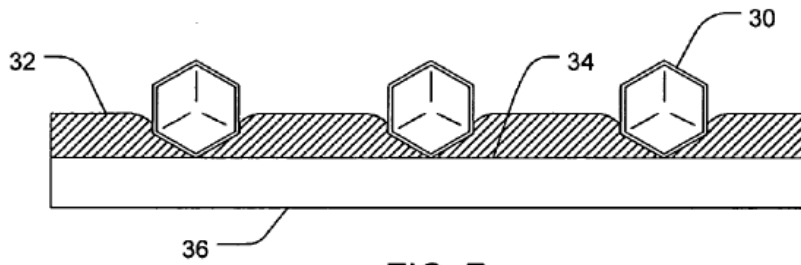


FIG. 7

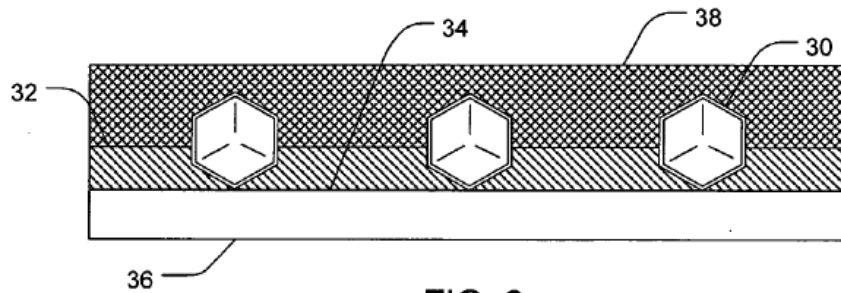


FIG. 8

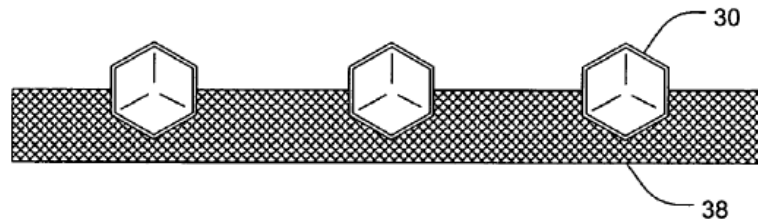


FIG. 9

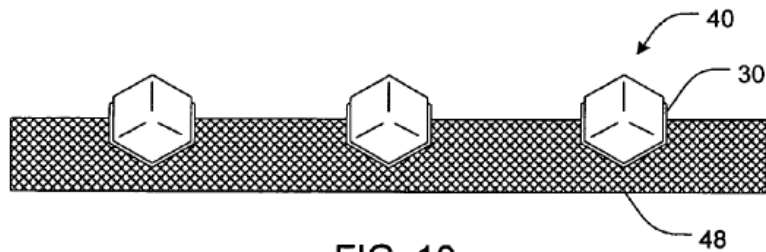


FIG. 10

EX1005, FIGS. 7-10. Sung'479's "reverse casting" process is the same technique described in the '270 Patent as allegedly being able to form the claimed CMP pad dresser. See EX1001, 14:26-33 ("Additionally, so-called 'reverse casting' methods

can be used to accurately orient and attach the dressing segments to the rigid support.”). Hence, Chou teaches, or at a minimum, Chou and Sung’479 render obvious, a monolayer of abrasive particles disposed on one side of a metal support layer. EX1002, ¶¶101-104.

- iii. **[1B] 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;**⁷

At the outset, as discussed in Section X [Claim Construction], the ’270 Patent notes that “for the purposes of the present disclosure, the term ‘protrusion’ refers to the height of a particle relative to some reference point.” Even assuming this is a lexicographic definition that must be applied, Chou in combination with Sung’479 renders obvious limitation [1B]. EX1002, ¶¶105-106, 116.

To briefly summarize, 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. Chou, however, does not explicitly teach that the difference in protrusion distance between the two highest protruding tips is less than or equal to

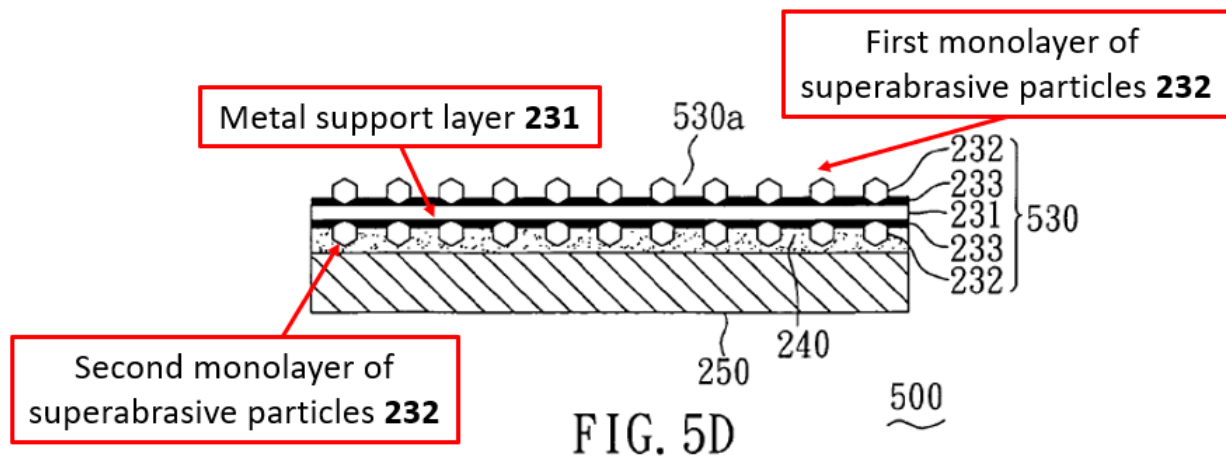
⁷ To be clear, limitation [1B] is the sole limitation of claim 1 of the ’270 Patent that is not recited in claim 1 of the ’699 Patent.

about 50 microns. Nevertheless, the claimed difference in protrusion distance would have been obvious to a POSITA, in light of Sung’479, which teaches tip height variations of only 2 microns or less across all superabrasive particles, as explained in greater detail below. EX1002, ¶¶105-125.

First, as for the teachings of Chou, as explained in Section XI.A.1.ii [limitation 1A], Chou discloses that the first monolayer of particles 232 has a protrusion (*i.e.*, a height relative to a reference point (*e.g.*, top of combining layer 233 or top of substrate 231)) distance. *See* EX1004, [0009] (“The grinding plate according to the present invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”), [0038]-[0044], [0054]-[0057], [0059], Figures 3A-3D, 5A-5D. EX1002, ¶107.

Chou further discloses adjusting the height of the abrasive particles so that *all* abrasive particles can perform the machining action to increase efficiency and precision. EX1004, [0017] (“Accordingly, the precision of the grinding plate can be controlled well and the height of the abrasive particles can be adjusted so as to ensure the performance of *all* abrasive particles in machining.”); *id.*, [0040] (“Accordingly, *each* of the abrasive particles 232 can efficiently perform machining so as to significantly enhance the machining efficiency and precision of the grinding tool and perform precision machining.”). EX1002, ¶108.

A POSITA would have readily recognized that in order for all of the abrasive particles to be performing the machining action, the difference in the protrusion distance between the particles should be small—as Chou’s Figure 5D illustrates.



EX1004, Fig. 5D (annotated); *see also id.* Figures 3A-3D, 5A-5C. EX1002, ¶109.

Second, although Chou does not explicitly mention the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles in a numerical form, such as less than or equal to about 50 microns, this was well-known in the art, as evidenced by Sung’479. EX1002, ¶110.

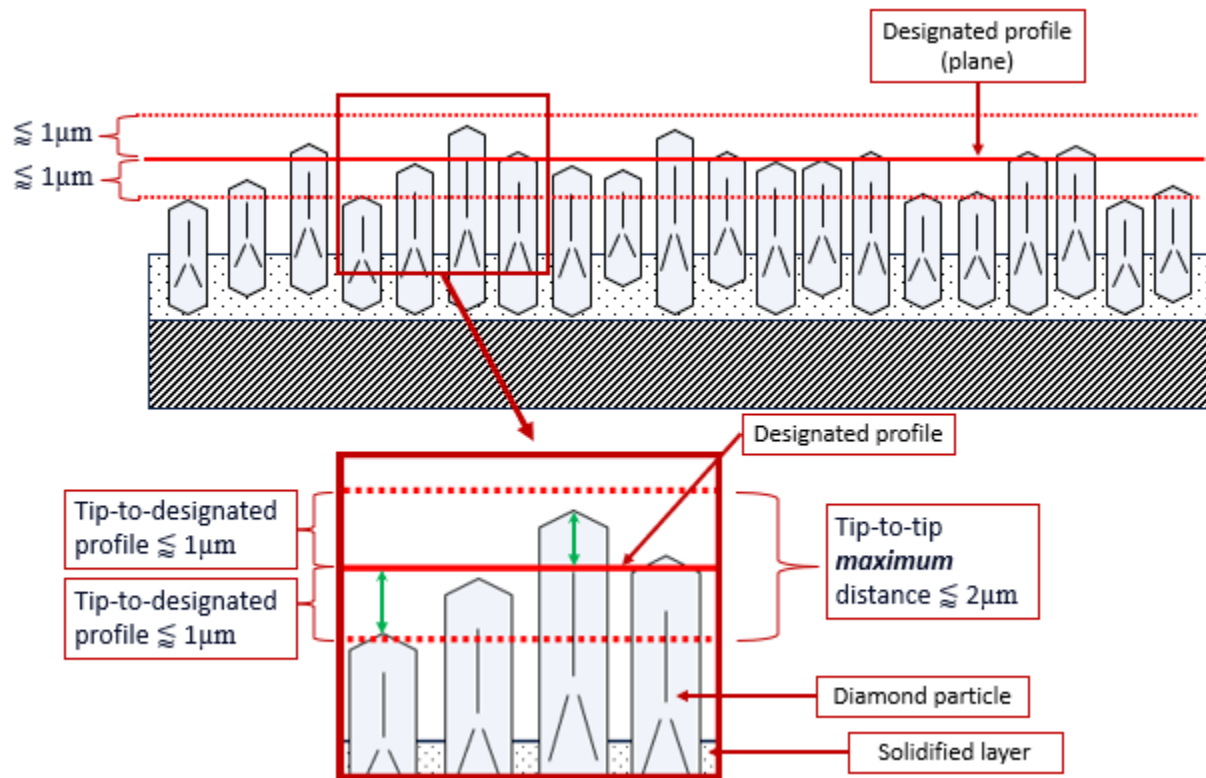
Specifically, as schematically illustrated below, Sung’479 teaches that the tips

of the superabrasive particles vary in height from a “designated profile”⁸ by less than about **1 micron** (*i.e.*, 2 microns tip-to-tip). See EX1005, [0072] (“[W]hile it is intended that the tips of the superabrasive particles align along the designated profile, some level of deviation may occur. ... Also, when referring to the designated profile, it should be noted that the term ‘tip’ is intended to include the highest protruding point of a superabrasive particle In yet another aspect, the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by **less than about 1 microns...**”),⁹ [0009] (“[I]n one aspect arranging the plurality of superabrasive particles may include ... disposing the plurality of superabrasive particles at least partially within the spacer layer such that a portion of **each** of the plurality of superabrasive particles contact the leveling surface.”),

⁸ “Designated profile” refers to “a predetermined height” “for the superabrasive particles to protrude from the solidified braze layer.” EX1005, [0069]. For example, “the designated profile may be a plane.” *Id.*

⁹ Sung’479 also describes a similar concept in which “the tips of the superabrasive particles may be leveled to an RA value of less than about 10 μm .” EX1005, [0067]; *see also* EX1011, 5:63-65 (“‘RA’ refers to a measure of the roughness of a surface as determined by the difference in height between a peak and a neighboring valley.”). EX1002, ¶112.

claim 4. See *Titanium Metals Corp. v. Banner*, 778 F.2d 775 (Fed. Cir. 1985) (“[W]hen, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is ‘anticipated’ if one of them is in the prior art.”).



Hence, Sung’479 explicitly teaches “the difference in protrusion distance between the highest protruding tip and the second highest protruding tip ... is less than or equal to about 50 microns.” At a minimum, Sung’479 inherently teaches this portion of limitation [1B]. EX1002, ¶¶111-114.

To the extent Patent Owner argues that Sung’479 does not explicitly or inherently teach this portion of limitation [1B] because it does not explicitly utilize the words “highest protruding tip and second highest protruding tip,” a POSITA

would have found it obvious to control the protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles to be less than or equal to about 50 microns in light of the teachings of Chou and Sung’479. As explained above, Chou teaches that “the precision of the grinding plate can be controlled well and the height of the abrasive particles can be adjusted so as to ensure the performance of all abrasive particles in machining.” EX1004, [0017]; *see also id.*, [0040]. Sung’479 similarly explains that “precisely 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.” EX1005, [0050]. And Sung’479 explains that tip height variations can be controlled to within 2 microns. *See* EX1005, [0072], [0009], claim 4. Hence, a POSITA would have been motivated to achieve tip height variations in superabrasive tools that are as small as possible (*e.g.*, to be within 2 microns) to improve the tool’s performance. Indeed, Sung’479 explains that “the highest protruding points of the superabrasive particles are intended to be substantially level.” EX1005, [0069]. A POSITA would have readily found it obvious that the two highest protruding points have as precisely leveled protrusion distances, based on the well-recognized benefits of a precisely leveled

surface. And a POSITA would have been able to achieve such precisely leveled CMP pad dressers with a reasonable expectation of success. EX1002, ¶115.

a. Reasons To Combine Chou With Sung’479

A POSITA would have had numerous reasons to combine Chou with Sung’479 and would have made the combination with a reasonable expectation of success. **First**, Chou and Sung’479 are analogous art to the claims as they are all directed to abrasive tools. EX1004, [0002] (“The present invention relates to a grinding tool and a method for fabricating the same and, more particularly, to a grinding tool and a method for fabricating the same that can improve the precision and lifetime of products, reduce the cost of production, and enhance the machining efficiency.”); EX1005, [0009] (“Accordingly, the present invention provides superabrasive tools and methods that are, without limitation, suitable to groom the CMP pads used for the delicate polishing applications as recited above.”), claim 39 (“wherein the superabrasive tool is a CMP pad dresser”); EX1001, claim 1 (“A CMP pad dresser...”). EX1002, ¶118.

Second, both Chou and Sung’479 disclose that the abrasive tools perform better if the abrasive particles are leveled. EX1004, [0017] (“Accordingly, the precision of the grinding plate can be controlled well and the height of the abrasive particles can be adjusted so as to ensure the performance of all abrasive particles in machining. Thereby, the machining efficiency of the working surface and precision

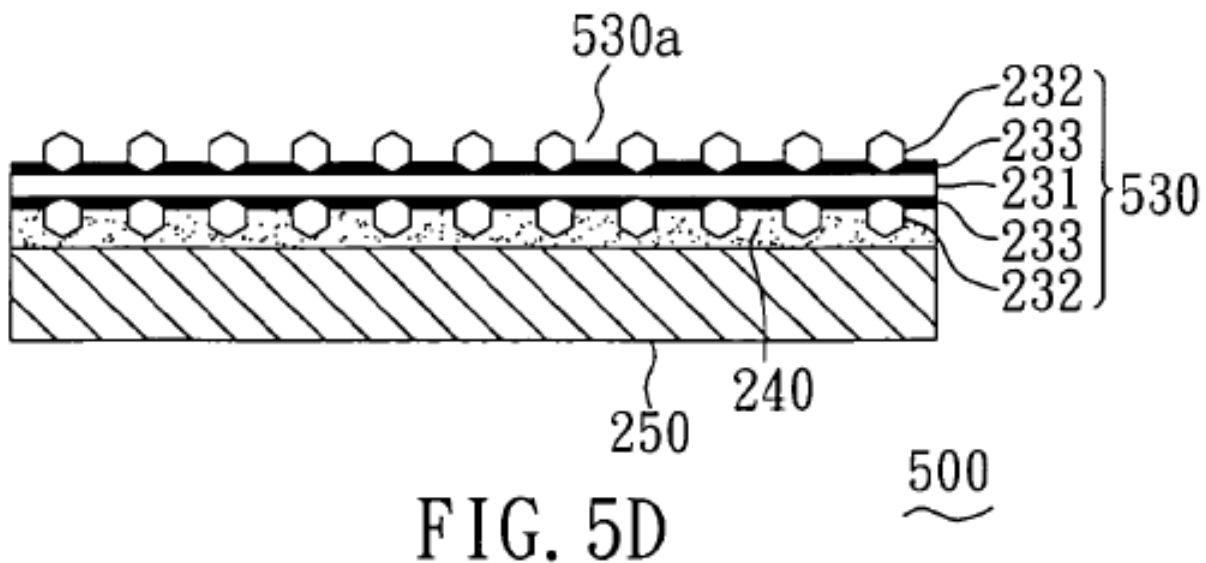
can be significantly enhanced, so that the grinding tool according to the present invention is especially suitable for precision machining.”); EX1005, [0003] (“Of particular importance to the quality of polishing achieved is the distribution of the abrasive particles throughout the pad.”), [0066]-[0067] (“Though various methods of minimizing mechanical stress are possible, in one aspect the arrangement of the plurality of superabrasive particles may be configured to uniformly distribute frictional forces across substantially all superabrasive particles. ... One potentially useful parameter may include the height that the superabrasive particles protrude above the solidified braze layer. A superabrasive particle that protrudes to a significantly greater height as compared to other superabrasive particles will experience a greater proportion of the impinging mechanical forces, and is thus more prone to pull out of the solidified braze layer. Thus an even height distribution of superabrasive particles may function to more effectively preserve the integrity of the superabrasive tool as compared to tools lacking such an even height distribution. Accordingly, the superabrasive particle tips may be leveled to spread the mechanical forces impinging on the tool across substantially all of the particles.”). A POSITA would have been motivated to combine references that recognize benefits of having leveled height of abrasive particles. And a POSITA would have considered leveling the height of the superabrasive particles to the level taught by the prior art references, such as a tip-to-tip variation that is less than about 2 microns. *See* EX1005, [0072]

(“In yet another aspect, the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by less than about 1 microns.”). EX1002, ¶¶119-120.

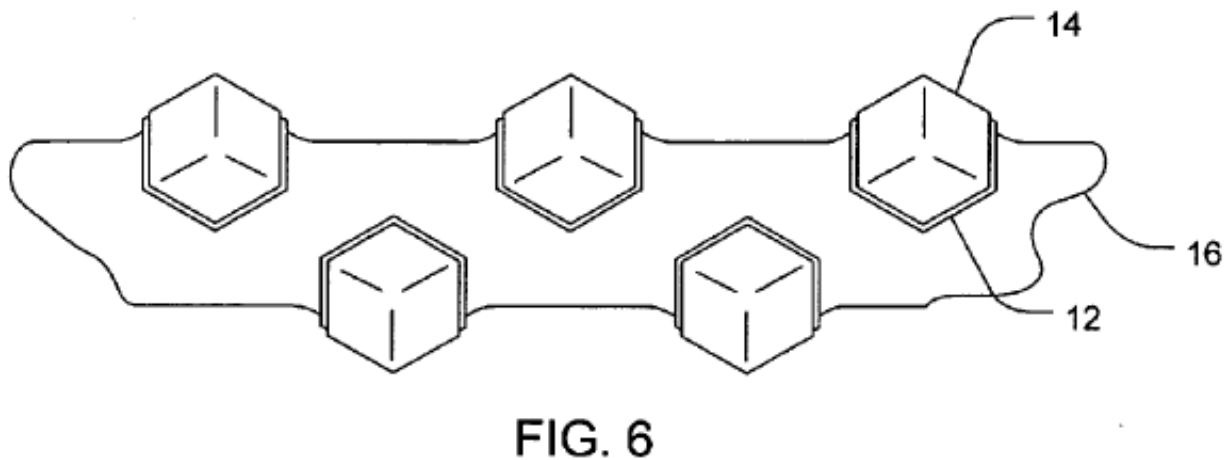
Third, Chou describes attaching diamond particles using brazes. EX1004, [0031] (describing forming abrasive particles 232 on substrate 231 “by brazing.”). Sung’479 also explains that “traditional metal braze alloys have the tendency to warp and buckle during a heating process.” EX1005, [0007]; *see also id.*, [0050]. As such, Sung’479 teaches that “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” and “do not generate significant warpage due to the lower temperatures utilize to construct the tool.” EX1005, [0050]. As such, a POSITA would have been motivated to combine the teachings of Chou with Sung’479 to achieve such benefits taught by Sung’479 in utilizing low-melting point brazes. As Sung’479 explains, “precisely 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.” EX1005, [0050]. EX1002, ¶121.

Fourth, both Chou and Sung’479 teach attaching a monolayer of diamond particles to both sides of the substrate. *See* EX1004, [0054] (“In the present

embodiment, the deformation resulting from the difference of shrinkage between the two surfaces of the soft substrate can be inhibited since both surfaces of the soft substrate 231 have abrasive particles 232...”; EX1005, [0054] (“Additionally, superabrasive particles 14 may be disposed ... along multiple surfaces as shown in FIG. 6.”).



EX1004, Figure 5D.



EX1005, Figure 6. EX1002, ¶122.

Fifth, 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 applications, such as CMP. EX1005, [0072] ("In yet another aspect, the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by less than about 1 microns."), [0013] (explaining that the use of the "low-melting braze materials" allow "the tips of the superabrasive particles [to] have an RA value of less than about 10 μm ."); EX1004, [0004] ("Grinding and polishing are ultra-precision machining technologies with the ability to make the surface of a workpiece have acceptable smoothness and flatness. Accordingly, grinding and polishing are widely used in precision machining of the surface of an object, such as hard and brittle metals, ceramics, glass and wafers."). EX1002, ¶123.

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. EX1004, [0039] ("Herein, the grinding plate 330 comprises: a soft substrate 231 having a working surface 231a and a non-working surface 231b and a plurality of abrasive particles 232 formed on the working surface 231a and the non-working surface 231b

of the soft substrate 231 by brazing.”); EX1005, [0013] (“The superabrasive tool may include a plurality of superabrasive particles coated with an intermediate layer and bonded together with a braze...”). EX1002, ¶124.

In fact, a POSITA would have recognized that additional benefits can be achieved by combining the teachings of Sung’479 with Chou, such as utilizing a low melting braze taught by Sung’479 with Chou, as they “do not generate significant warpage due to the low temperatures utilized” and “reduce[] problems associated with warping.” EX1005, [0050], [0065]. EX1002, ¶125.

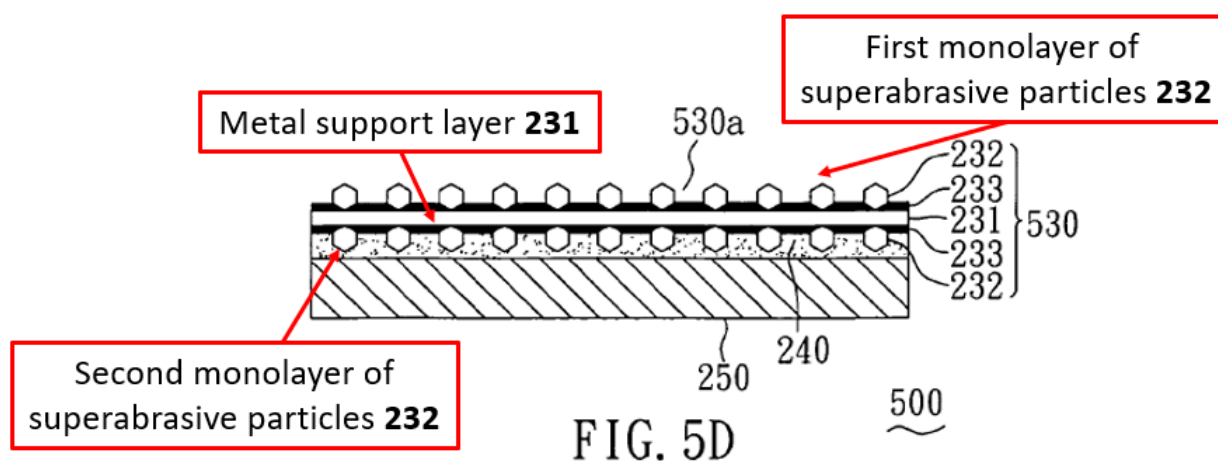
iv. [1C] a second monolayer of superabrasive particles disposed on the metal support layer on an opposite side from the first monolayer;

At the outset, as discussed in Section X [Claim Construction], the ’270 Patent notes that “[a]s used herein, ‘superabrasive’ may be used to refer to any crystalline or polycrystalline material or mixture of such materials which has a Moh[]s hardness of about 8.0 or greater.” Even assuming this is a lexicographic definition that must be applied, Chou discloses limitation [1C]. EX1002, ¶¶126-127.

First, as explained in Section XI.A.1.ii [Limitation 1A], Chou discloses a substrate 231 that can be made of metal and meets the claimed “metal support layer.” EX1004, [0051] (“The material of the soft substrate 231 is a metal.”). EX1002, ¶128.

Second, Chou discloses a second monolayer of abrasive particles 232

disposed on the metal substrate 231 on the non-working surface 530b (*i.e.*, on an opposite side of the working surface 530a). For example, as shown in Figure 5D below, a single layer of particles 232 is disposed on the side of the non-working surface 530b of the metal substrate 231 that is opposite the working surface 530a. *See* EX1004, [0009] (“The grinding plate according to the present invention can comprise: a soft substrate having a working surface and a non-working surface; and a plurality of abrasive particles distributed over the working surface of the soft substrate.”), [0038]-[0044], [0054]-[0058]. And because the second monolayer of superabrasive particles 232 is illustrated as a single layer, it meets the claimed “monolayer.” *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (holding that drawings and pictures can anticipate claims if they clearly show the structure which is claimed); *see also* *See* IPR2014-01523, Paper 26 (Final Written Decision), 16, 23 (finding that Chou discloses “a second monolayer of superabrasive particles disposed on and coupled to the metal support layer on an opposite side from the first monolayer” claimed in the ’699 Patent).



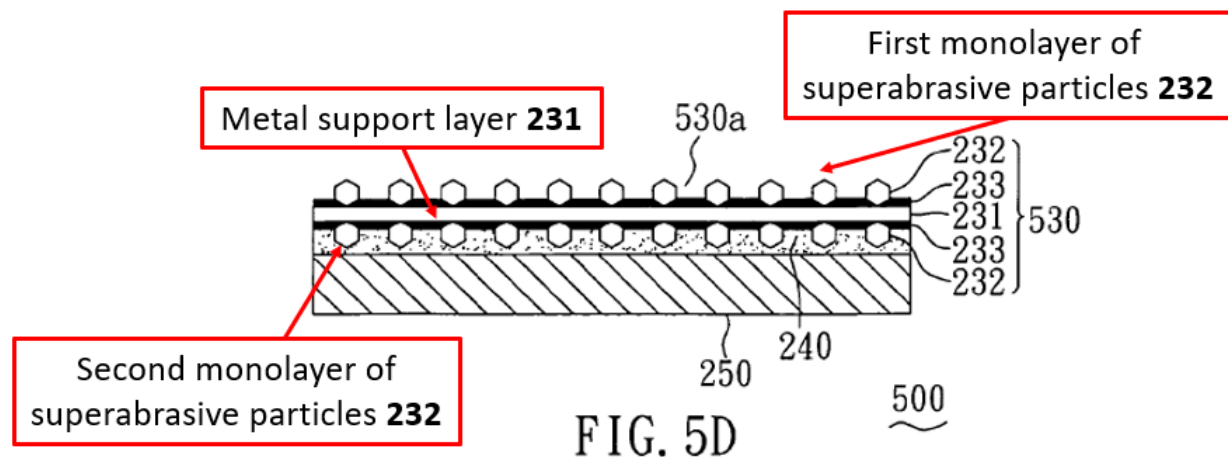
EX1004, Fig. 5D (annotated); *see also id.* Figures 3A-3D, 5A-5C. EX1002, ¶¶129-130.

Finally, Chou teaches that the abrasive particles are diamond particles, which have a Mohs hardness of about 8.0 or greater. EX1004, [0009], [0022] (“The abrasive particles can be any material with high hardness, ... Preferably, the abrasive particles are diamond particles.”), [0058] (“The material of the soft substrate 231 is a metal, and the abrasive particles 232 are diamond particles...”); *see also* EX1001, 8:59-65 (explaining that “the superabrasive particles include diamond materials”). EX1002, ¶131.

- v. **[1D] wherein the superabrasive particles of the second monolayer are positioned to have substantially the same distribution as the superabrasive particles of the first monolayer; and**

Chou discloses limitation [1D]. *See* IPR2014-01523, Paper 26, 19–21.¹⁰
EX1002, ¶132.

More specifically, as shown in Fig. 5D (reproduced below), the superabrasive particles of the first and the second monolayers are positioned to have substantially the same distribution. *See* EX1004, [0038]-[0040], [0054]-[0059], Figures 3A-3D, 5A-5D.



EX1004, Fig. 5D (annotated). Indeed, as the Board held in the earlier '699 Kinik

¹⁰ In view of the '699 Kinik IPR FWD, Patent Owner is collaterally estopped from advancing the argument that Chou does not disclose limitation 1[D]. *See* Section XII [Collateral Estoppel].

IPR, “[d]rawings and pictures can anticipate claims if they clearly show the structure which is claimed.” IPR2014-01523, Paper 26, 19 (*citing In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972)); *see also In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979) (“a drawing in a utility patent can be cited against the claims of a utility patent application even though the feature shown in the drawing was unintended or unexplained in the specification of the reference”). As such, the Board previously concluded that “Figures 3A-3D and 5A-5D, if nothing else, disclose to one of ordinary skill the alignment of certain objects relative to other objects.” *Kinik Co. v. Sung*, IPR2014-01523, Paper 26, 20. EX1002, ¶¶133-134.

Chou teaches that the purpose of providing the monolayer of superabrasive particles on both the working and non-working surfaces 530a and 530b is to mitigate the warpage of the substrate that results from the difference of the shrinkage between the two surfaces. *See* EX1004, [0009] (“In addition, the abrasive particles can be further distributed over the non-working surface of the soft substrate. That is, the abrasive particles are distributed over the two surfaces of the soft substrate. Accordingly, the deformation resulting from the difference of shrinkage between the two surfaces can be inhibited. Herein, the abrasive particles can be directly formed on the surface of the soft substrate by brazing, sintering or electroplating.”), [0039], [0054] (“In the present embodiment, the deformation resulting from the difference of shrinkage between the two surfaces of the soft substrate can be inhibited since

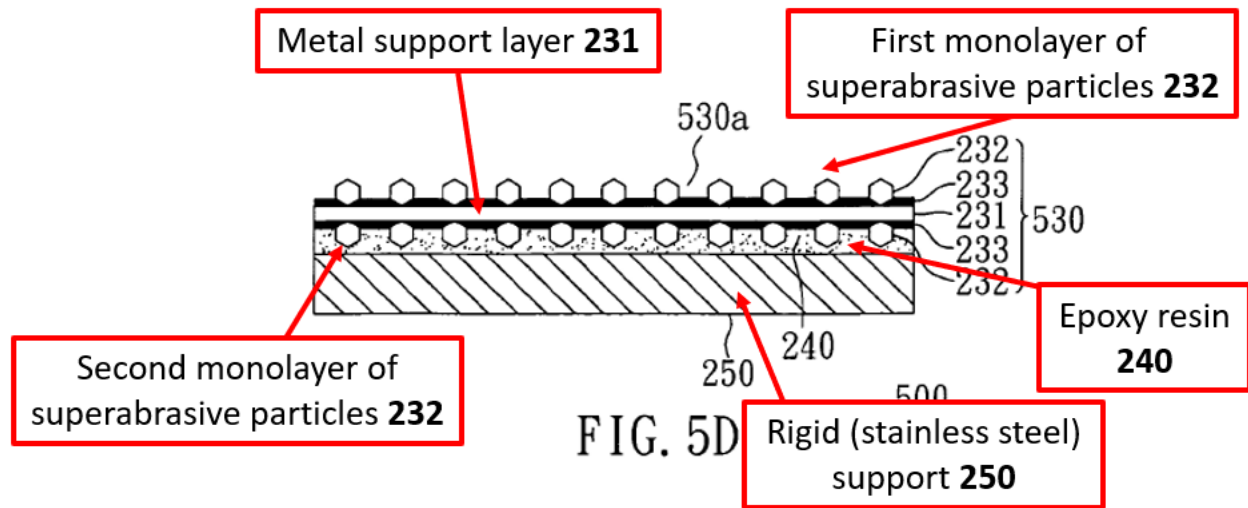
both surfaces of the soft substrate 231 have abrasive particles 232 and a combining layer 233 thereon.”). EX1002, ¶135.

This is the same reason the ’270 Patent provides for adding a second monolayer of abrasive particles opposite to the first monolayer. EX1001, 2:18-24 (“The method further includes bonding the first monolayer of superabrasive particles and the second monolayer of superabrasive particles to the metal support layer such that symmetrical forces due to the substantially similar distribution between the first monolayer and the second monolayer precludes substantial warping of the metal support layer.”). EX1002, ¶136.

vi. [1E] a rigid support coupled to the second monolayer of superabrasive particles opposite the first monolayer.

Chou discloses limitation [1E]. As shown below, Chou teaches an epoxy resin 240 and a stainless steel rigid support 250 coupled to the second monolayer of superabrasive particles 232 opposite the first monolayer of superabrasive particles 232. *See* EX1004, [0012]-[0016], [0041]-[0043], [0049]-[0052], [0058] (“In the present embodiment, the material of the backplane 250 is stainless steel...”), Figures 3A-3D, 5A-5D. Epoxy is a rigid material. *See* EX1001, 14:10-18 (“Various organic materials are contemplated for use as a rigid support... Examples of suitable organic matrix materials include ... epoxy resins...”). And stainless steel is a rigid material. *See* EX1001, 13:23-24 (“In some aspects, the rigid support can be a non-

polymeric material such as a metal layer.”).



EX1004, Fig. 5D (annotated). EX1002, ¶¶138-139.

2. Dependent Claims 3 And 4

- i. [3] The dresser [of] claim 1, wherein the plurality of superabrasive particles are configured in an attitude having a sharp portion oriented towards a pad to be dressed.

[4] The dresser of claim 1, wherein the plurality of superabrasive particles are substantially all configured in an attitude having either an apex or an edge portion oriented toward a pad to be dressed.

At the outset, as discussed in Section X [Claim Construction], the '270 Patent notes that “[a]s used herein, ‘sharp portion’ means any narrow portion to which a crystal or particle may come, including but not limited to corners, *apexes*, ridges, edges, obelisks, and other protrusions.” The '270 Patent also notes that “[a]s used herein, ‘attitude’ means the position or arrangement of a superabrasive particle in

relation to a defined surface, such as a substrate to which it is attached, or a CMP pad to which it is to be applied during a work operation.” Even assuming these are lexicographic definitions that must be applied, Sung’479 discloses the added limitations of claims 3 and 4. EX1002, ¶¶140-143.

Sung’479 explains that “the plurality of superabrasive particles may be substantially configured with an apex portion oriented towards a work piece.” EX1005, [0074]. In other words, Sung’479 discloses an apex, which is one example of the claimed “narrow portion.” Moreover, Sung’479 discloses the claimed “attitude,” because Sung’479 discloses the position or arrangement of the superabrasive particles in relation to the work piece (*i.e.*, the CMP pad to which the CMP pad dresser is to be applied). *See* EX1005, [0002] (explaining that CMP pad is a “work piece”). Sung’479 explains that “impinging frictional forces may be reduced by orienting the plurality of superabrasive particles such that their tips of apexes are substantially oriented towards the work piece.” EX1005, [0074]; *see also id.*, [0073], [0079]. EX1002, ¶¶143-144.

3. Dependent Claims 5-8

- i. **[5] The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 10 microns.**

[6] The dresser of claim 5, wherein the difference in protrusion distance between the highest protruding tip and the 10th highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 20 microns.

[7] The dresser of claim 6, wherein the difference in protrusion distance between the highest protruding tip and the 100th highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 40 microns.

[8] The dresser of claim 1, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 20 microns.

For the same reasons as explained above in Section XI.A.1.iii [limitation 1B], Chou in combination with Sung’479 render obvious the added limitations of claims 5-8. Specifically, the added limitations of claims 5 and 8 merely claim that the difference in protrusion distance between the highest and second highest protruding tips are less than 10/20 microns. The added limitations of claims 6 and 7 further add that the difference in protrusion distance between the highest and 10th/100th highest protruding tips are less than about 20/40 microns. All of these added limitations of claims 5- 8 are taught by Sung’479, which teaches that the tips of the superabrasive particles vary in height from a “designated profile” by less than about *1 microns* (*i.e.*, 2 microns tip-to-tip). *See* Section XI.A.1.iii [limitation 1B]. And because a POSITA would have readily recognized that typical CMP pad dressers have well

over 100 protruding tips, claims 5-8 are also taught (explicitly or inherently) or at least rendered obvious by Chou and Sung’479. EX1002, ¶145.

B. Ground II: Chou With Sung’479 And SungECS Renders Obvious Claims 6-7

1. Dependent Claims 6-7

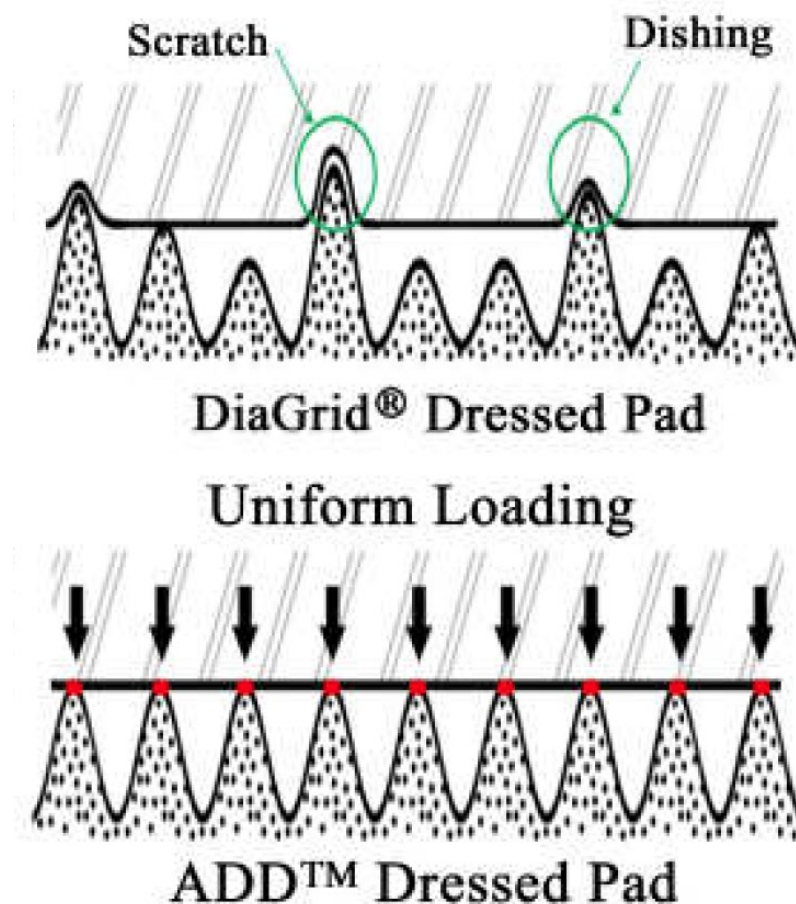
- i. [6] The dresser of claim 5, wherein the difference in protrusion distance between the highest protruding tip and the 10th highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 20 microns.

[7] The dresser of claim 6, wherein the difference in protrusion distance between the highest protruding tip and the 100th highest protruding tip of the first monolayer of superabrasive particles is less than or equal to about 40 microns.

As explained above in Section XI.A.3 [5-8], and for the reasons also discussed in Section XI.A.1.iii [1B], Chou in combination with Sung’479 renders obvious the added limitations of claims 6-7. However, to the extent Patent Owner argues neither Chou nor Sung’479 explicitly discloses the actual number of protruding tips, it was common knowledge that CMP pad dressers typically have tens of thousands of superabrasive particles distributed thereon. EX1002, ¶¶146-148.

For instance, SungECS shows an example of a diamond disk called BDD (“brazed diamond disk” with a commercial name “DiaGrid[®]”) and ADD (“advanced diamond disk”). EX1007, 524:1-3 (“BDD, [refers to] the conventional *brazed* diamond disks.”), Fig. 3 caption (“DiaGrid[®] refers to BDD pad conditioner.”),

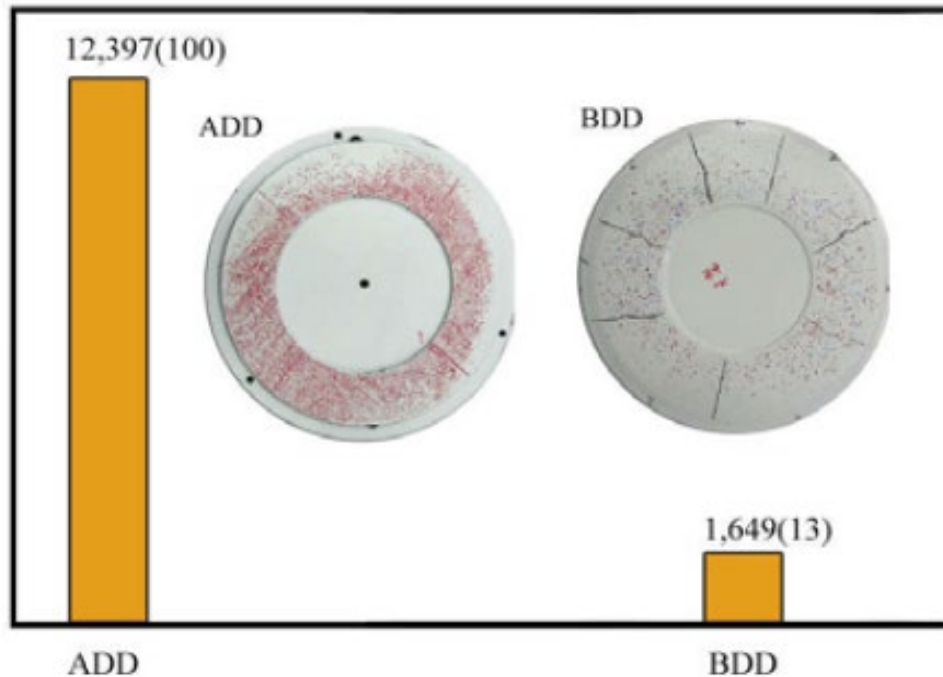
523:1-3 (“[A]dvanced diamond disk (ADD) is made by carving a disk of sintered polycrystalline diamond (PCD) layer to form cutting tips of predetermined shape and distribution.”). As schematically illustrated in Figure 3 below, the ADD is “fully leveled” “within a few microns” whereas the BDD have a “conventional range of 50 to 100 microns for highest points of discrete diamond grits.” EX1007, Fig. 7 caption.



EX1007, Fig. 3. EX1002, ¶148.

As a result, SungECS explains that although both disks have the same number of cutting tips, “the contact points on pad during dressing increases by more than

tenfold compared to BDD.” EX1007, 524:1-3; *see also id.*, Fig. 2 caption (“Both disks have about the same number of cutting tips to begin with the test.”).

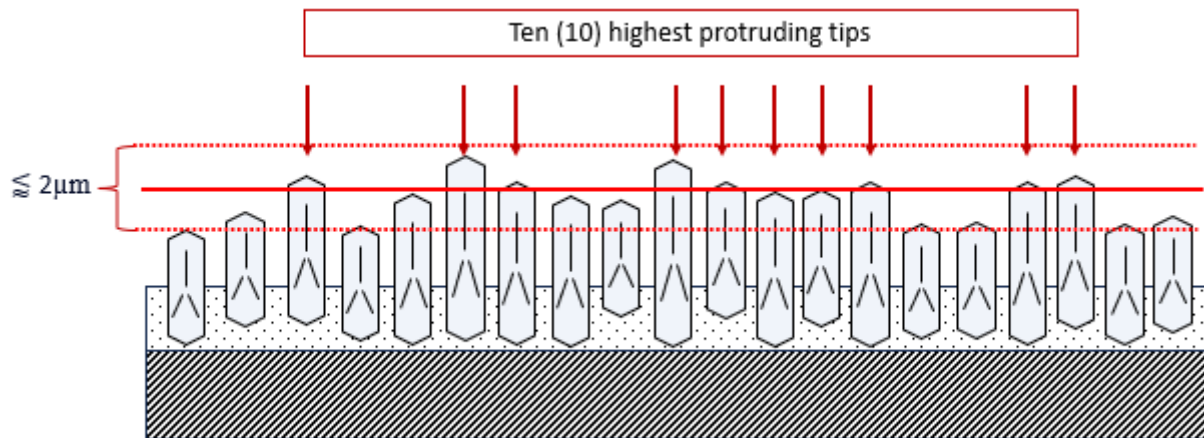


EX1007, Fig. 2. EX1002, ¶149.

In other words, it was well-known that typical CMP pad dressers have tens of thousands of diamond particles. And a POSITA would have readily recognized that smaller tip variations would lead to a larger number of tips contacting the CMP pad. Indeed, SungECS demonstrates this well-known fact in the above comparison of ADD and BDD in Figure 2. EX1002, ¶150.

And similar to SungECS’s ADD, Sung’479 teaches that *all* diamond particles have a protrusion distance within less than about 2 μm and therefore contact the CMP pad. *See* EX1005, [0072] (“[W]hile it is intended that the tips of the

superabrasive particles align along the designated profile, some level of deviation may occur. ... Also, when referring to the designated profile, it should be noted that the term ‘tip’ is intended to include the highest protruding point of a superabrasive particle In yet another aspect, the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by ***less than about 1 microns.***”), [0009] (“[I]n one aspect arranging the plurality of superabrasive particles may include ... disposing the plurality of superabrasive particles at least partially within the spacer layer such that a portion of ***each*** of the plurality of superabrasive particles contact the leveling surface.”), claim 4.



EX1002, ¶147, 151.

In sum, in light of (1) the large number of superabrasive particles that were known to be present on a CMP pad dresser as taught by SungECS and (2) the fact that each one of Sung’479’s diamond particles contact the CMP pad surface, the combination of Chou, Sung’479, and SungECS render obvious a CMP pad

conditioner having the 10th highest protruding tip and the 100th highest protruding tip to be less than about 2 microns and meet the claimed “less than or equal to about 40 microns.” EX1002, ¶¶146-151.

2. Reasons to Combine Chou With Sung’479 and SungECS

A POSITA would have had numerous reasons to combine Chou with Sung’479 and SungECS and would have made the combination with a reasonable expectation of success. EX1002, ¶152.

First, Chou, Sung’479, and SungECS are analogous art to the claim and are all directed to abrasive tools, such as those used for CMP pad dressing. EX1004, [0002] (“The present invention relates to a grinding tool and a method for fabricating the same and, more particularly, to a grinding tool and a method for fabricating the same that can improve the precision and lifetime of products, reduce the cost of production, and enhance the machining efficiency.”); EX1005, [0009] (“Accordingly, the present invention provides superabrasive tools and methods that are, without limitation, suitable to groom the CMP pads used for the delicate polishing applications as recited above.”); EX1007, Title (“Polycrystalline Diamond (PCD) Shaving Dresser: The Ultimate Diamond Disk (UDD) for **CMP Pad Conditioning**.”); EX1001, claim 1 (“A CMP pad dresser...”). EX1002, ¶153.

Second, the combination of SungECS with Chou and Sung’479 is a trivial combination that merely sets forth that CMP pad dressers typically contain tens of

thousands of diamond particles and the claimed “10th highest protruding tip” and “100th highest protruding tip” would be expected to be found in the CMP pad dressers described by Chou and Sung’479. Accordingly, combining the knowledge of the typical number of particles on a CMP pad dresser with Chou and Sung’479 would have been a trivial modification with a predictable result that a POSITA would have been able to carry out with a reasonable expectation of success. EX1002, ¶154.

C. Ground III: Chou With Sung’479 And Goers Renders Obvious Claim 2

1. Dependent Claim 2

- i. **[2] The dresser of claim 1, wherein the plurality of superabrasive particles are arranged in at least one annular configuration having a central region devoid of superabrasive particles.**

An annular configuration having a central region devoid of superabrasive particles was well-known in the art. For example, as shown below in Figure 1A, Goers teaches such a configuration. *See* EX1006, [0030] (“To reduce the likelihood of abrasive particles breaking loose from the substrate 4 in the region where the substrate is formed (for example, cut) to a desired shape, and/or to permit operation of a sensor provided with the abrasive article, a portion of the substrate may be provided free of abrasive particles. This *particle free zone may, for example, be formed near the center of the abrasive article*, or may extend a certain distance

along the entire peripheral edge of the abrasive article, as shown in FIG. 1A. For a typical conditioning disk having a generally circular or annular shape, a ***particle free zone may be provided both near the disk center*** and at the outer peripheral edge portion of the substrate.”).

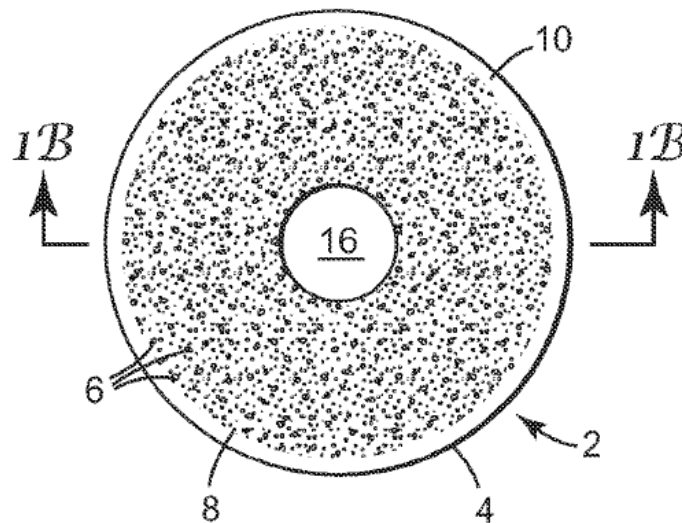


FIG. 1A

EX1006, Fig. 1A. And it would have been obvious to arrange the plurality of superabrasive particles in an annular configuration, such as shown by Goers, where the central region is devoid of superabrasive particles. EX1002, ¶156.

i. Reasons to Combine Chou With Sung’479 and Goers

A POSITA would have had numerous reasons to combine Chou with Sung’479 and Goers and would have made the combination with a reasonable expectation of success. EX1002, ¶¶157-160.

First, Chou, Sung’479 and Goers are analogous art to the claim and are all directed to abrasive tools, such as those used for CMP pad dressing. EX1004, [0002] (“The present invention relates to a grinding tool and a method for fabricating the same and, more particularly, to a grinding tool and a method for fabricating the same that can improve the precision and lifetime of products, reduce the cost of production, and enhance the machining efficiency”); EX1005, [0009] (“Accordingly, the present invention provides superabrasive tools and methods that are, without limitation, suitable to groom the CMP pads used for the delicate polishing applications as recited above.”); EX1006, [0005] (“In general, the present invention relates to abrasive articles... Exemplary abrasive articles include polishing pads (CMP pads) and CMP pad conditioners...”); EX1001, claim 1 (“A CMP pad dresser...”). EX1002, ¶158.

Second, it would have been a trivial modification by POSITA to arrange the abrasive particles in an annular configuration, as taught by Goers. For example, Sung’479 teaches that the superabrasive particles can be arranged in different configurations between the central and the peripheral regions of the CMP pad dresser because the dresser can experience different mechanical stresses. See EX1005, [0057] (“In a spinning disk, for example, larger superabrasive particles may be located more centrally and smaller superabrasive particles may be located more peripherally in order to counteract location-dependent variations in mechanical

stress associated with rotational velocity.”), [0073] (“In another aspect, superabrasive particles in a central location of the tool may be smaller than superabrasive particles in a peripheral location on the tool. This configuration may provide benefit to circumferentially rotating tools, where the mechanical stresses on superabrasive particles are greater at the periphery.”). EX1002, ¶159.

Rather than utilizing different sized superabrasive particles as Sung’479 teaches, another known way—as Goers teaches—was to utilize a particle free zone in the central region. See EX1006, [0030] (“To reduce the likelihood of abrasive particles breaking loose from the substrate 4 in the region where the substrate is formed (for example, cut) to a desired shape, and/or to permit operation of a sensor provided with the abrasive article, a portion of the substrate may be provided free of abrasive particles. This *particle free zone may, for example, be formed near the center of the abrasive article*, or may extend a certain distance along the entire peripheral edge of the abrasive article, as shown in FIG. 1A. For a typical conditioning disk having a generally circular or annular shape, a *particle free zone may be provided both near the disk center* and at the outer peripheral edge portion of the substrate.”). Arranging the superabrasive particles in an annular configuration, such as shown in Goers, would have been merely one predictable choice among a finite number of choices for arranging the superabrasive particles onto a circular CMP pad dresser substrate. Such a modification would have been a

trivial modification with a predictable result that a POSITA would have been able to carry out with a reasonable expectation of success. EX1002, ¶160.

For at least these reasons, a POSITA would have found it obvious to combine the teaching of Chou, Sung’479, and Goers to arrange superabrasive particles in at least an annular configuration having a central region devoid of superabrasive particles with a reasonable expectation of success. EX1002, ¶160.

XII. Collateral Estoppel Should Apply For At Least [1Pre] And [1D]

Sung is collaterally estopped from re-litigating the issue of whether the Chou reference discloses at least [1Pre] and [1D] of the ’270 Patent. “Under collateral estoppel, once an issue is actually and necessarily determined by a court of competent jurisdiction, that determination is conclusive in subsequent suits based on a different cause of action involving a party to the prior litigation.” *Montana v. U.S.*, 440 U.S. 147, 153 (1979) (emphasis added); *see also Papst Licensing GMBH & Co. KG v. Samsung Elecs. Am., Inc.*, 924 F.3d 1243, 1250–51 (Fed. Cir. 2019) (“Following the Supreme Court’s conclusion in *B & B Hardware* that those standards are met by certain adversary proceedings before the Trademark Trial and Appeal Board, we have held that the same is true of an IPR proceeding before the Patent Trial and Appeal Board, so that the issue preclusion doctrine can apply in this court to the Patent Trial and Appeal Board’s decision in an IPR once it becomes final.”).

For a finding of collateral estoppel—i.e., issue preclusion—four factors must be met: “(1) the issue is identical to one decided in the first action; (2) the issue was actually litigated in the first action; (3) resolution of the issue was essential to a final judgment in the first action; and (4) [the estopped party] had a full and fair opportunity to litigate the issue in the first action.” *In re Freeman*, 30 F.3d 1459, 1465 (Fed. Cir. 1994). Here, all four factors are met.

First, “the issue is identical to one decided in the first action.” *Id.* As explained in Section VI.B [Prosecution History], [1Pre] and [1D] of the ’270 Patent is identical to the corresponding preamble/limitation of claim 1 of the ’699 Patent—with the differences highlighted in bold italics. As shown, the “only difference between the claims is” in limitation [1D], where the corresponding limitation in the ’699 Patent adds “further comprising.” But for the purposes of this Petition, this difference does not materially alter the identity of the issues.

Claim 1 of the ’270 Patent	Claim 1 of the ’699 Patent
[1Pre] A CMP pad dresser, comprising:	A CMP pad dresser, comprising:
[1D] wherein the superabrasive particles of the second monolayer are positioned to have substantially the same distribution as the superabrasive particles of the first monolayer; and	wherein the superabrasive particles of the second monolayer are positioned to have substantially the same distribution as the superabrasive particles of the first monolayer; and <i>further comprising</i>

Second, “the issue was actually litigated in the first action.” *In re Freeman*, 30 F.3d at 1465. Sung fully litigated the issue of unpatentability of claim 1 of the ’699 Patent up to final written decision—specifically focusing its arguments on [1Pre] and [1D]. Moreover, Sung elected not to appeal the Board’s finding of unpatentability to the Federal Circuit.

Third, “resolution of the issue was essential to a final judgment in the first action.” *In re Freeman*, 30 F.3d at 1465. Specifically, the question of whether Chou discloses [1Pre] and [1D] was the two primary arguments raised by Sung and was essential to the resolution of the ’699 Kinik IPR.

Finally, Sung “had a full and fair opportunity to litigate the issue in the first action.” *In re Freeman*, 30 F.3d at 1465. Sung had a full and fair opportunity to litigate the issues surrounding [1Pre] and [1D] throughout the ’699 Kinik IPR, with its counsel raising these arguments regarding [1Pre] and [1D] all the way up to oral arguments.

In sum, Sung is collaterally estopped from arguing that Chou does not disclose [1Pre] and [1D] of the ’270 Patent based on the Board’s determination in the ’699 Kinik IPR.

XIII. Discretionary Factors Favor Institution

The discretionary factors the Board employs for its institution decisions favor institution.

A. *Advanced Bionics* Factors Favor Institution

The Board uses a two-prong test to determine whether it will deny institution under 35 U.S.C. § 325(d): (1) whether the same or substantially the same art or arguments were previously presented to the Office; and (2) if first part is satisfied, whether the Office erred in a manner material to the patentability of challenged claims. *See Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (precedential).

At the outset, Goers was never considered during prosecution of the '270 Patent and does not meet the first prong of *Advanced Bionics*.

Chou and Sung'479 are listed on the cover of the '270 Patent. EX1001, Cover. But the second part of *Advanced Bionics* favors institution for several reasons.

First, Chou and Sung'479 were merely two out of over four hundred fifty (450) documents submitted to the Examiner. EX1003, 56-65, 85, 86, 93, 94, 124, 131, 132, 139, 201, 253, 254, 261, 263, 962, 963, 1081, 1291, 1293, 1302. Importantly, neither Chou nor Sung'479 were relied upon in any substantive rejections by the Office during the original prosecution of the '270 Patent. Indeed, Grounds based on references cited in an IDS but not considered at any length should not serve as the basis for denying institution under 35 U.S.C. § 325(d). The Board has repeatedly instituted IPRs where the relied-upon references had been merely

cited by the applicant among numerous references submitted in IDSs during prosecution of the original application, without forming a basis of any rejections by the Examiner. *See Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17-18 (precedential); *see also Hum Industrial Technology, Inc. v. Amsted Rail Company, Inc.*, IPR2023-00539, Paper 10 at 51 (“We do not consider the Examiner’s initials on an IDS citing almost 100 references with the Examiner’s failure to use LeFebvre or Armitage to reject claims of the ’673 patent application as indicating that the Examiner sufficiently evaluated or appreciated the relevance of either reference.”).

In fact, in the earlier IPR2014-01523, the Patent Owner did not even raise a challenge under 35 U.S.C. §325(d), despite Chou being listed on the cover of the ’699 Patent. That is unsurprising because, just like in the ’270 Patent, Chou was merely one among several hundreds of pieces of prior art submitted to the Examiner, and Chou was never relied upon in any substantive rejection by the Office during the original prosecution of the ’699 Patent either.

More specifically, as to Chou, the Examiner issued a Notice of Allowance on December 19, 2014 without applying Chou, despite the fact that Kinik submitted its IPR petition for the ’699 Patent on September 19, 2014, applying Chou to the limitations that are nearly verbatim identical. *See Kinik Co. v. Chien-Min Sung*, IPR2014-01523, Paper 1. Indeed, not only did the Patent Owner fail to disclose the

filing of the Petition to the Examiner, but the Patent Owner failed to submit the Institution Decision dated February 20, 2015, finding that Chou likely anticipates claim 1 of the '699 Patent. But the Patent Owner could have (and should have) submitted these highly relevant papers to the Examiner via an Information Disclosure Statement before the '270 Patent issued on March 10, 2015. Hence, without the benefit of such critical disclosures, the Office erred by not applying Chou to the claims that is material to patentability of the claims.

As to Sung'479, Sung'479 was not simply one out of 450 total documents cited by Sung, but one of 49 different co-pending applications cited by Sung. In other words, the Examiner was inundated with a voluminous amount of irrelevant information. EX1003, 56-65, 85, 86, 93, 94, 124, 131, 132, 139, 201, 253, 254, 261, 263, 962, 963, 1081, 1291, 1293, 1302. Sung'479 was never highlighted to the Office, nor was there any substantive discussion of Sung'479 in the file history. Accordingly, the Office erred by failing to apply Sung'479 at least to limitation [1B], despite the fact that Sung'479 contains disclosure that is material to the patentability of the claims.

In short, *Advanced Bionics* factors favor institution.

B. *Fintiv* Factors Favor Institution

The six *Fintiv* factors considered favor institution. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (precedential).

1. No Evidence Regarding A Stay

No motion to stay has been filed, so this factor is neutral.

2. Parallel Proceeding Trial Date

The median time from filing to trial in the Eastern District of Texas is currently approximately 21 months, which means that trial is expected just shortly before or around the expected time of the Board's Final Written Decision.¹¹ EX1020. However, no trial date is currently scheduled, and the Final Pretrial Conference is scheduled for September 3, 2025, which means that actual trial is expected to occur *after* the time of the Board's Final Written Decision. *See* EX1012, 5. This factor favors institution, or at a minimum is neutral.

3. Investment In Parallel Proceeding

The co-pending litigation is in its early stages, and the investment in it has been minimal. *See* EX1012. The parties have not exchanged preliminary positions on claim construction, and discovery has just begun. *See PEAG LLC v. Varta Microbattery GmbH*, IPR2020-01214, Paper 8, 17. Further, the Markman hearing

¹¹ Petitioner expects a notice of accorded filing date for this petition to be in March 2025, which means a Final Written Decision is expected sometime around September 2025.

is not scheduled until September 4, 2024 , which is after the expected institution decision date by the Board. *See* EX1012, 2. This factor favors institution.

4. Overlapping Issues With The Parallel Proceeding

Petitioner stipulates that if the IPR is instituted, Petitioner will not pursue the same grounds in the district court litigation. *Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (informative). This factor favors institution.

5. Identity Of Parties

Petitioner is the defendant in the litigation. This factor should not be a basis for denying institution.

6. Other Circumstances, Including The Merits

“[T]he PTAB will not deny institution of an IPR or PGR under *Fintiv* (i) when a petition presents compelling evidence of unpatentability.” Memorandum, “Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation,” 9 (June 21, 2022). Here, the evidence of unpatentability is compelling, further evidenced by the Board’s prior Final Written Decision in IPR2014-01523, which already held claim 1 of the ’699 Patent (which is nearly identical to claim 1 of the ’270 Patent, except for one limitation) unpatentable based on the same prior art reference (Chou). Thus, this factor also favors institution.

Accordingly, *Fintiv* factors favor institution.

C. General Plastic Factors Favor Institution

The '270 patent has not been challenged in any prior IPR petition, so none of the *General Plastic* factors apply to this Petition and favor institution.

XIV. Conclusion

Petitioner respectfully requests that the Board institute *inter partes* review, hold the challenged claims unpatentable, and cancel the challenged claims.

Dated: February 29, 2024

Respectfully submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

I hereby certify that this Petition for *Inter Partes* Review of U.S. Patent No. 8,974,270 has, excluding the portions exempted under 37 C.F.R. § 42.24(a), 11,822 words as counted by the word-processing system used to prepare this document, in compliance with 37 C.F.R. § 42.24(d).

Dated: February 29, 2024

Respectfully submitted,

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Counsel for Petitioner

Samsung Electronics Co. Ltd.

CERTIFICATE OF SERVICE

Under 37 C.F.R. §§ 42.6(e) and 42.126, the undersigned certifies that on February 29, 2024, complete copies of the foregoing and any accompanying exhibits were caused to be served by sending them via Federal Express Priority Overnight shipping, which is at least as fast and reliable as U.S. Priority Mail Express, to the correspondence address of record for U.S. Patent No. 8,974,270 as indicated in Patent Center:

Devlin Law Firm
1526 Gilpin Ave.
Wilmington, DE 19806

Dated: February 29, 2024

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