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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
SHERMAN DIVISION

CHIEN-MIN SUNG, Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC., SAMSUNG SEMICONDUCTOR, INC., and SAMSUNG AUSTIN SEMICONDUCTOR, LLC, Defendants.	Civil Action No. 4:23-cv-00752 **JURY TRIAL DEMANDED**

DEFENDANTS' P.R. 3-3 INVALIDITY CONTENTIONS

Under P.R. 3-3, Defendants Samsung Electronics Co., Ltd. ("SEC"), Samsung Electronics America, Inc. ("SEA"), Samsung Semiconductor, Inc. ("SSI"), and Samsung Austin Semiconductor, LLC ("SAS") (collectively, "Defendants") hereby provide their P.R. 3-3 Invalidity Contentions, including charts attached as Exhibits 862-1 through 862-12 and 802-1 through 802-13, to Plaintiff Chien-Min Sung ("Sung" or "Plaintiff"), with respect to the asserted claims of U.S. Patent Nos. 9,138,862 (the "'862 Patent") and 9,724,802 (the "'802 Patent") (collectively, the "Asserted Patents") identified in Plaintiff's P.R. 3-1 Infringement Contentions dated February 21, 2024 ("P.R. 3-1 Infringement Contentions").[1]

In his P.R. 3-1 Infringement Contentions, Sung has asserted the following claims (collectively, the "Asserted Claims") against Defendants:

[1] Plaintiff no longer asserts any claims of U.S. Patent No. 8,974,270 (the "'270 Patent") or claims 14 and 16 of the '862 Patent. Defendants reserve the right to amend their P.R. 3-3 Invalidity Contentions if Plaintiff is permitted to amend his Infringement Contentions to re-assert the '270 Patent and/or claims 14 and 16 of the '862 Patent.

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Asserted Patents	Asserted Claims
’862 Patent	1–13, 15, and 17–20
’802 Patent	1–21

With respect to each Asserted Claim and based on their investigation to date, and at least under Plaintiff’s apparent application of the Asserted Claim, Defendants hereby (1) identify each item of prior art that anticipates and/or renders obvious each Asserted Claim; (2) specify whether each such item of prior art anticipates and/or renders obvious each Asserted Claim, and, if it renders the Asserted Claim obvious, explains how the prior art renders the asserted claim obvious and identifies examples of combinations of prior art showing obviousness; (3) provide charts identifying where and how in each item of prior art each limitation of each Asserted Claim is found; and (4) identify the grounds of invalidity based on indefiniteness, enablement, or written description under pre-AIA or AIA 35 U.S.C. § 112 of any of the Asserted Claims.

In addition, pursuant to P.R. 3-4 and based on its investigation to date, Defendants have produced documents within their possession, custody, and control required to accompany these Invalidity Contentions.

I. RESERVATION OF RIGHTS

Consistent with P.R. 3-6, Defendants reserve the right to amend these Invalidity Contentions. Defendants base these Invalidity Contentions on their current knowledge and understanding of Plaintiff’s Infringement Contentions, the prior art, and other facts and information available. Discovery is ongoing, and Defendants have not yet completed their investigation, information collection, discovery, or analysis relating to this action. Defendants reserve the right to supplement these contentions based on materials found during discovery, and to introduce and use such materials at trial.

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The prior art cited in the claim charts is illustrative and not exhaustive. Further, the citations for a claim limitation are for exemplary purposes only and should not be deemed exhaustive. Other portions of the identified prior art may additionally, implicitly, expressly, or inherently disclose one or more limitations of the Asserted Claims or render obvious one or more limitations of the Asserted Claims. Defendants thus reserve the right to rely on such uncited portions of the identified prior art to establish the invalidity of the Asserted Claims. Similarly, where Defendants cite a patent figure in the charts, it incorporates the accompanying specification text describing that figure and vice-versa. Moreover, Defendants reserve the right to rely on uncited portions of the identified prior art, other prior art, or expert testimony to provide context to or to aid in understanding the identified prior art.

To the extent that prior art identified by Defendants as anticipating is found not to anticipate, the prior art establishes that the claimed subject matter would have been obvious to a person of ordinary skill in the art ("POSITA") at the time of the alleged invention. Even if a claim element is not expressly or inherently found in one of the charted references, those charted references render the relevant Asserted Claims obvious without the need to combine with any other references, having in mind the information generally known to those skilled in the art, common sense, and routine innovation. Accordingly, Defendants disclose each of the references cited as rendering obvious the Asserted Claims as shown in the accompanying claim charts. In addition, each charted reference (in combination with one or more of the other charted references) renders obvious the Asserted Claims. As used in these Invalidity Contentions, "reference" includes any type of prior art under pre-AIA or AIA § 102 (including product prior art).

As explained in these Invalidity Contentions, it would have been obvious to a POSITA at the time of the alleged invention of the Asserted Claims to combine the various references cited

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for one of the Asserted Patents so as to practice the Asserted Claims. In addition to the disclosed combinations of prior art and groups of prior art, Defendants reserve the right to rely on any other combination of prior art references disclosed in these Invalidity Contentions. Defendants further reserve the right to rely on combinations disclosed within the prosecution histories of the references cited in these Invalidity Contentions. These obviousness combinations reflect Defendants' present understanding of the potential scope of the claims that Plaintiff appears to be advocating and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the Asserted Claims.

Any reference or combination of references that anticipates or renders obvious an asserted independent claim also anticipates or renders obvious any claim dependent thereon, because every element of each dependent claim was known by persons of ordinary skill at the time of the alleged inventions, and it would have been obvious to combine those known elements with the independent claims as a matter of common sense and routine innovation. Accordingly, Defendants contend that each Asserted Claim would have been obvious not only by these contentions' explicitly defined combinations, but also by any combination of references that renders obvious an Asserted Claim upon which it depends.

Numerous prior art references, including those identified in the attachments hereto, reflect common knowledge and the state of the art before the priority dates of the Asserted Patents. As it would be unduly burdensome to create detailed claim charts for the thousands of invalidating combinations, Defendants have provided illustrative examples of such invalidating combinations herein and in the charts attached hereto. For at least the reasons described herein and in the accompanying claim charts, it would have been obvious to a POSITA to combine any prior art references, including those identified in the attached claim charts for one of the Asserted Patents,

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to satisfy the limitations of the Asserted Claims of that patent. As such, Defendants' inclusion of exemplary combinations does not preclude Defendants from identifying other invalidating combinations.

To the extent Plaintiff challenges a combination of prior art with respect to a particular claim element, Defendants reserve all rights to supplement these contentions to further specify the reasons to combine the prior art. Defendants may rely on cited or uncited portions of the prior art, other documents, or expert testimony to establish that a POSITA would have been motivated to modify or combine the prior art so as to render the claims obvious.

The identification of any patent or patent publication includes any counterpart patent or application filed, published, or issued anywhere in the world.

Defendants further rely on and incorporate all prior art references cited in and on the cover of the Asserted Patents and their respective prosecution histories.

Defendants reserve the right to identify additional prior art references that becomes known during discovery in this case, including (1) patents; (2) nonpatent literature (NPL); and (3) nonpatent and nonpublication prior art systems that were sold, offered for sale, used, and imported before the Asserted Patents' respective priority dates.

Defendants have served requests for documents and testimonies to third parties, and Defendants reserve the right to supplement their Invalidity Contentions based on information known through third-party discovery. Third parties have stated that the Court's *sua sponte* Protective Order does not protect materials produced by non-parties and therefore have not provided information responsive to Defendants' subpoenas. For example, Defendants subpoenaed several third parties, including 3M Company ("3M") and Entegris, Inc. ("Entegris"), and were informed by 3M and Entegris that they would not be able to produce documents until an

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appropriate protective order was in place. Defendants have not yet completed their investigation, information collection, discovery, or analysis based on third-party discovery, and reserve the right to supplement these contentions based on materials found during discovery, and to introduce and use such materials at trial.

Defendants reserve the right to modify, amend, and/or further supplement their Invalidity Contentions to show the invalidity of any additional claims that the Court may allow Plaintiff to later assert. Defendants also reserve the right to modify, amend, and/or further supplement their Invalidity Contentions to address any modification, amendment, and/or supplementation to Plaintiff's Infringement Contentions.

To the extent that these Invalidity Contentions reflect or otherwise embody construed terms or phrases in the Asserted Claims, Defendants do not propose that those are proper constructions of those terms or phrases. Various positions set forth in these Invalidity Contentions are predicated on Plaintiff's incorrect and overbroad interpretation of the Asserted Claims as evidenced by Plaintiff's Infringement Contentions. These Invalidity Contentions are not intended to reflect Defendants' interpretation of the true and proper scope of the Asserted Claims or any individual claim limitation. Defendants reserve the right to adopt claim construction positions that differ from or even conflict with positions set forth herein. Also, Defendants object to any attempt to infer any claim constructions from any identification of potential prior art. In those instances where Defendants assert that the Asserted Claims are invalid under pre-AIA or AIA § 112 (i.e., no written description, not enabled, and indefinite), Defendants have applied the prior art under Plaintiff's apparent application of the claims as evidenced in Plaintiff's Infringement Contentions. As such, Defendants' Invalidity Contentions do not represent Defendants' agreement or view as to the meaning of, definiteness of, written description support for, or enablement of any Asserted Claim.

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These Invalidity Contentions and accompanying documents do not reflect Defendants' claim construction contentions, which will be disclosed in accordance with the Court's Scheduling Order (D.I. 37).

Defendants' contentions may change depending on the Court's construction of the Asserted Claims, any findings as to the Asserted Claims' priority dates, and Plaintiff or his experts' positions concerning claim construction, infringement, and invalidity issues. Prior art not included in this disclosure, whether known or unknown to Defendants, may become relevant; Defendants are unaware of the extent to which Plaintiff will contend the Asserted Claims' limitations are absent in Defendants' identified prior art, or will contend that any of the identified references do not qualify as prior art. To the extent that such an issue arises, Defendants reserve the right to identify other references that, *inter alia*, would have made the addition of the allegedly missing limitation to the disclosed device or method obvious.

Defendants also reserve the right to challenge the Asserted Claims' patentability under § 102(f) if Defendants obtain evidence that the Asserted Patents' named inventors did not invent the subject matter claimed therein. Should Defendants obtain such evidence, Defendants will provide the name(s) of the person(s) from whom and the circumstances under which the invention or any part of it was derived.

Wherever Defendants cite the beginning Bates number of a document, the citation should be understood to refer to the entirety of the document.

Defendants further reserve the right to assert that the Asserted Patents are unenforceable due to inequitable conduct.

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II. PRIORITY DATES OF THE ASSERTED PATENTS AND CLAIMS

In his Infringement Contentions, Plaintiff asserts that the Asserted Patents are entitled to the following priority date ranges:[2]

- **'862 Patent**: "at least as early as May 23, 2011 but no later than March 13, 2013"
- **'802 Patent**: "at least as early as May 16, 2005 but no later than October 3, 2014"

For the reasons provided below, Defendants contend that the '862 Patent is entitled to a priority date no earlier than March 13, 2013; and the'802 Patent is entitled to a priority date no earlier than October 3, 2014.[3]

A. The '862 Patent Is Entitled to a Priority Date No Earlier Than March 13, 2013.

On its face, the '862 Patent, filed on March 13, 2013, is a continuation-in-part of U.S. Patent No. 8,974,270 (the "'270 Patent"), filed on May 23, 2012, which in turn claims priority to U.S. Provisional Patent Application Serial No. 61/489,074 (the "'074 Provisional"), filed on May 23, 2011.

The Asserted Claims of the '862 Patent, however, are not entitled to a priority date earlier than its filing date (March 13, 2013) because the '270 Patent and the '074 Provisional do not support the following claim limitations:

- "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns" (Claim 1)
- "at least 100 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated" (Claim 2)

[2] Since Plaintiff does not assert any claims of the '270 Patent, Defendants reserve the right to contest the priority date of the '270 Patent should Plaintiff be permitted to assert the '270 Patent.
[3] Under the proper priority dates, the '862 Patent is subject to the pre-America Invents Act (AIA), and the '802 Patent is subject to the AIA.

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- "at least 50 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated" (Claim 3)
- "at least 25 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated" (Claim 4)
- "substantially all of the asperities are cut in the CMP pad by superabrasive particles located at a peripheral location of the dresser" (Claim 5)
- "substantially all of the superabrasive particles are located at a peripheral location of the dresser"(Claim 9)
- "substantially all of the superabrasive particles are arranged in uniform predetermined pattern at a peripheral location of the dresser" (Claim 10)
- "the semiconductor device includes one or more layers of Cu, W, an oxide layer, or a combination thereof" (Claim 13)
- "the semiconductor device has a line width of less than or equal to about 30 nm" (Claim 15)
- "the slurry includes an abrasive selected from the group consisting of silica, alumina, ceria, and combinations thereof" (Claim 17)
- "the slurry includes an oxidative compound" (Claim 18)
- "the oxidative compound is hydrogen peroxide" (Claim 19)
- "the CMP pad is polyurethane" (Claim 20)

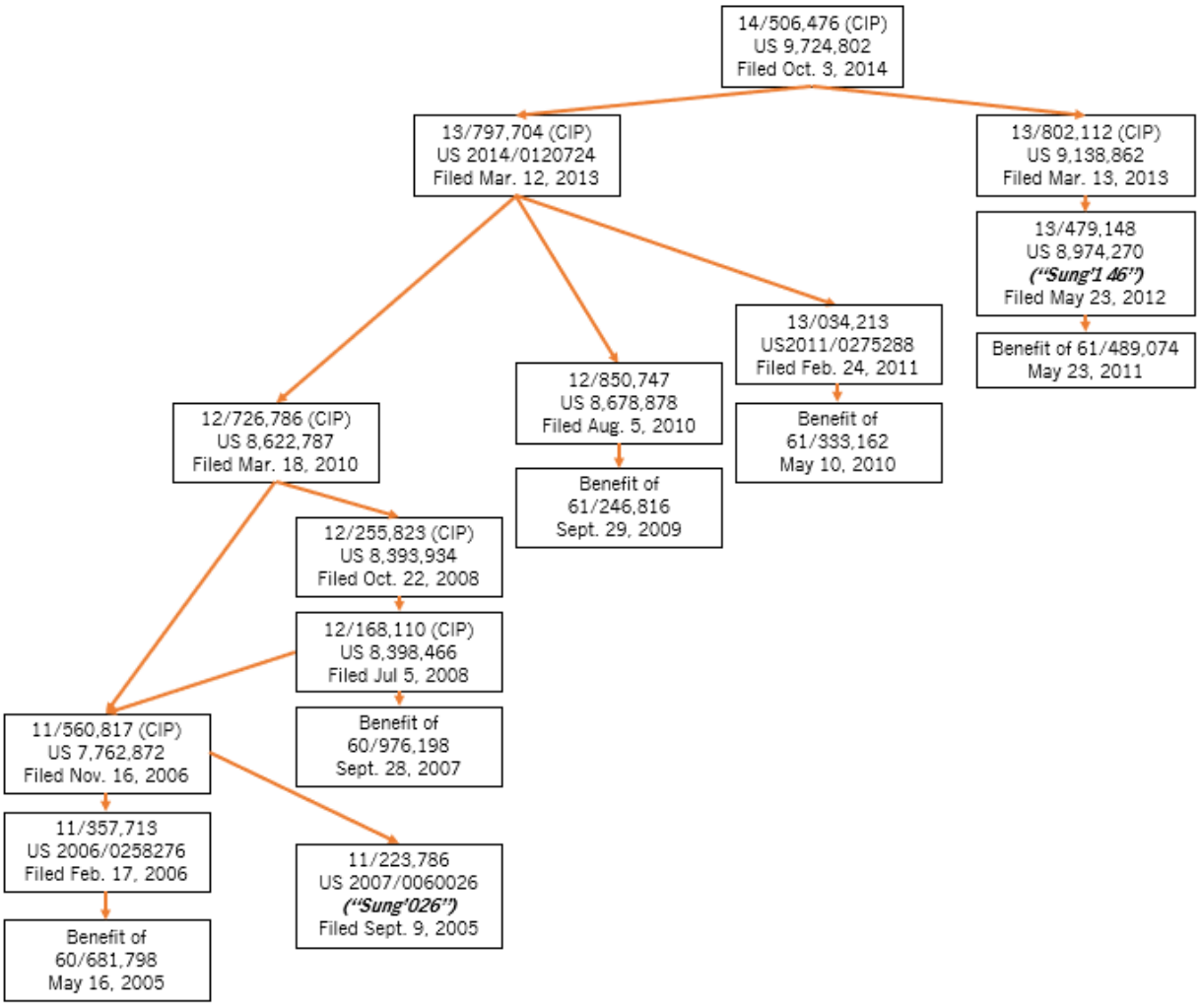
Accordingly, the '862 Patent is entitled to a priority date no earlier than March 13, 2013, and is subject to the pre-AIA version of the patent statutes. *E.I. du Pont de Nemours & Co. v. MacDermind Printing Sols., L.L.C.*, 525 F.3d 1353, 1358 (Fed. Cir. 2008; *New Railhead Mfg.,*

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L.L.C. v. Vermeer Mfg. Co., 298 F.3d 1290, 1296 (Fed. Cir. 2002); *Studiengesellschaft Kohle, M.B.H. v. Shell Oil Co.*, 112 F.3d 1561, 1564 (Fed. Cir. 1997).

B. The '802 Patent Is Entitled to a Priority Date No Earlier Than October 3, 2014.

The '802 Patent issued from U.S. Patent Application No. 14/506,476 (the "'476 Application"), filed on October 3, 2014.The '802 Patent was filed as a continuation-in-part (CIP), claiming priority to numerous applications, summarized below:

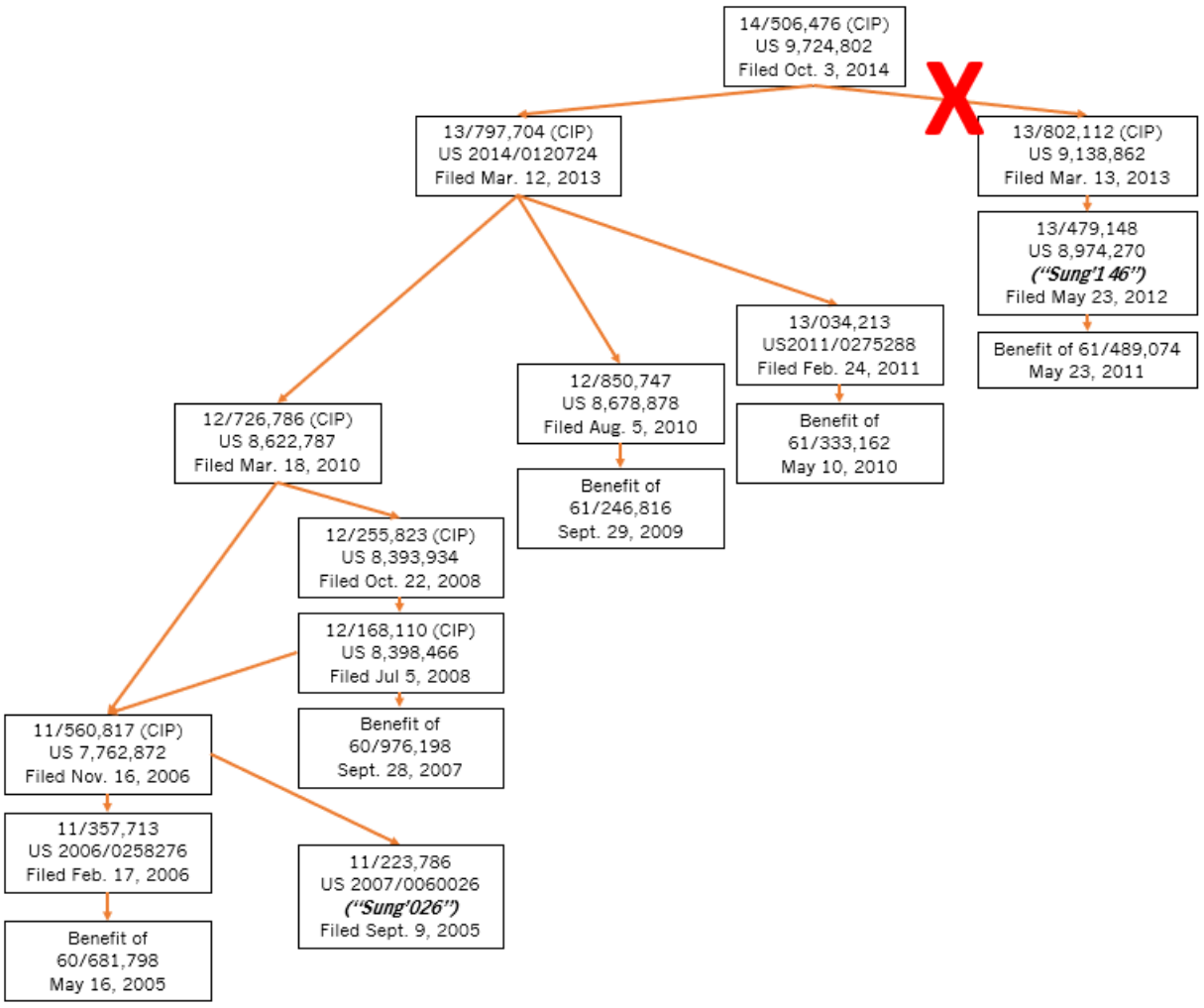


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The ’802 Patent, however, is not entitled to a priority date earlier than its filing date—October 3, 2014—because Plaintiff disclaimed any claim to an earlier filing date. During his litigation against Kinik, Plaintiff declared:

> After the joint venture [with Kinik] terminated, I continued to conduct my own research and development in CMP disk technology. During this period, I invented the subject matter that forms the basis of the patent application (the “’802 Application”) from which the ’802 Patent issued. . . . ***I invented this new subject matter, which is claimed in the ’802 Patent, after the joint venture with Kinik ended Oct. 28, 2013.This invention is not disclosed in any of the patents or patent applications to which the ’802 Patent claims priority***. . . . For example, neither the ’862 Patent nor the ’270 Patent discloses a designated profile with a tip variation associated with the superabrasive particles or a tip variation at, for example, about 100 microns, all of which was discovered by me after the joint venture had terminated.

Sung v. Kinik Co., No. 20-cv-00247 (D. Del.) (“*Kinik* Action”), D.I. 18 (“Sung Decl.”), ¶¶ 17–21 (emphasis added); *id.* ¶ 24 (“declar[ing] that all statements made [t]herein on [Dr. Sung’s] own knowledge are true and . . . that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both”); *see also Kinik* Action, D.I. 25 at 1 (“Regarding the priority date of [the ’802 Patent], Plaintiff advise the Court that its contention is and will remain that the priority date is Oct. 3, 2014 (i.e., the filing date of the application leading directly to the ’802 patent).”). Indeed, as graphically illustrated below using a red X, Plaintiff intentionally disclaimed any claim to an earlier priority date off the ’862 and ’270 Patents’ priority chain.



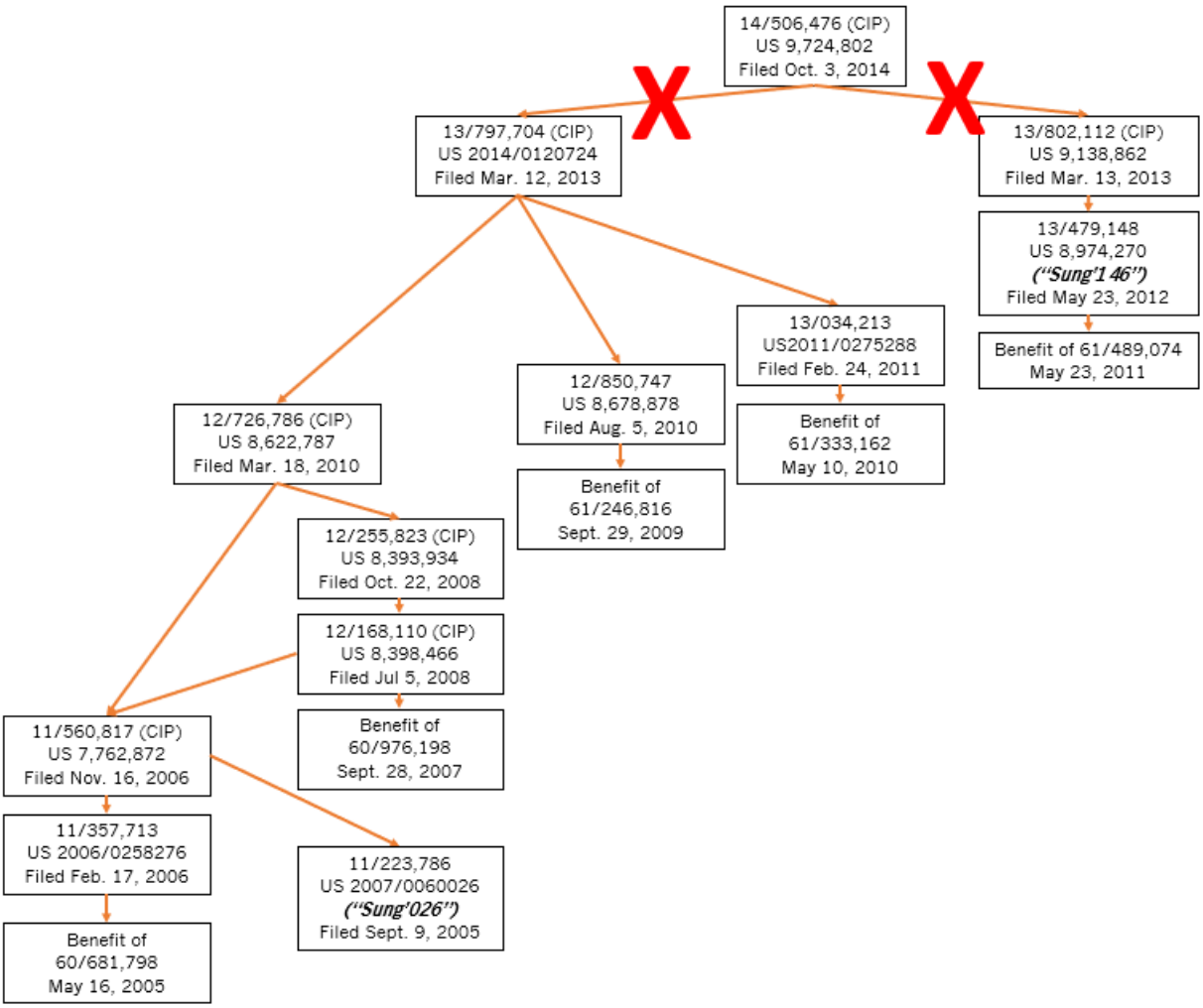
Plaintiff further declared that a break in priority exists between the '802 Patent and its immediate remaining parent (i.e., U.S. Application No. 13/797,704). Specifically, Plaintiff declared:

> Further, I am the inventor of . . . U.S. Application No. 13/797,704 ("'704 Application"). . . . ***[T]he '704 Application [does not] disclose the claimed subject matter of the '802 Patent.***

Sung Decl., ¶¶ 22 (emphasis added). In other words, Plaintiff intentionally disclaimed the benefit to the '704 Application effectively "deleting" the benefit to the remaining priority chain. *See, e.g.*, *Nat. Alts. Int'l, Inc. v. Iancu*, 904 F.3d 1375, 1383 (Fed. Cir. 2018) (finding that "by deleting the benefit claim in a CIP application, . . . the CIP application and its children become vulnerable to

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rejections based on a larger pool of prior art—including former parent applications in some cases"); *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1352 (Fed. Cir. 2012) (finding that "[d]ue to breaks in the chain of priority," the "[parent] patent [was] prior art for some of the asserted claims").



And the Delaware court acknowledged Plaintiff's renunciation of any earlier priority claim. *See Kinik* Action, D.I. 26 ("Order Den. Stay") at 2 ("Plaintiff has clearly stated that he only claims priority to ***October 3, 2014***." (emphasis added)). These intentional disclaimers, in an effort to sidestep Plaintiff's then-pending disputes over the ownership of the '802 Patent between Plaintiff

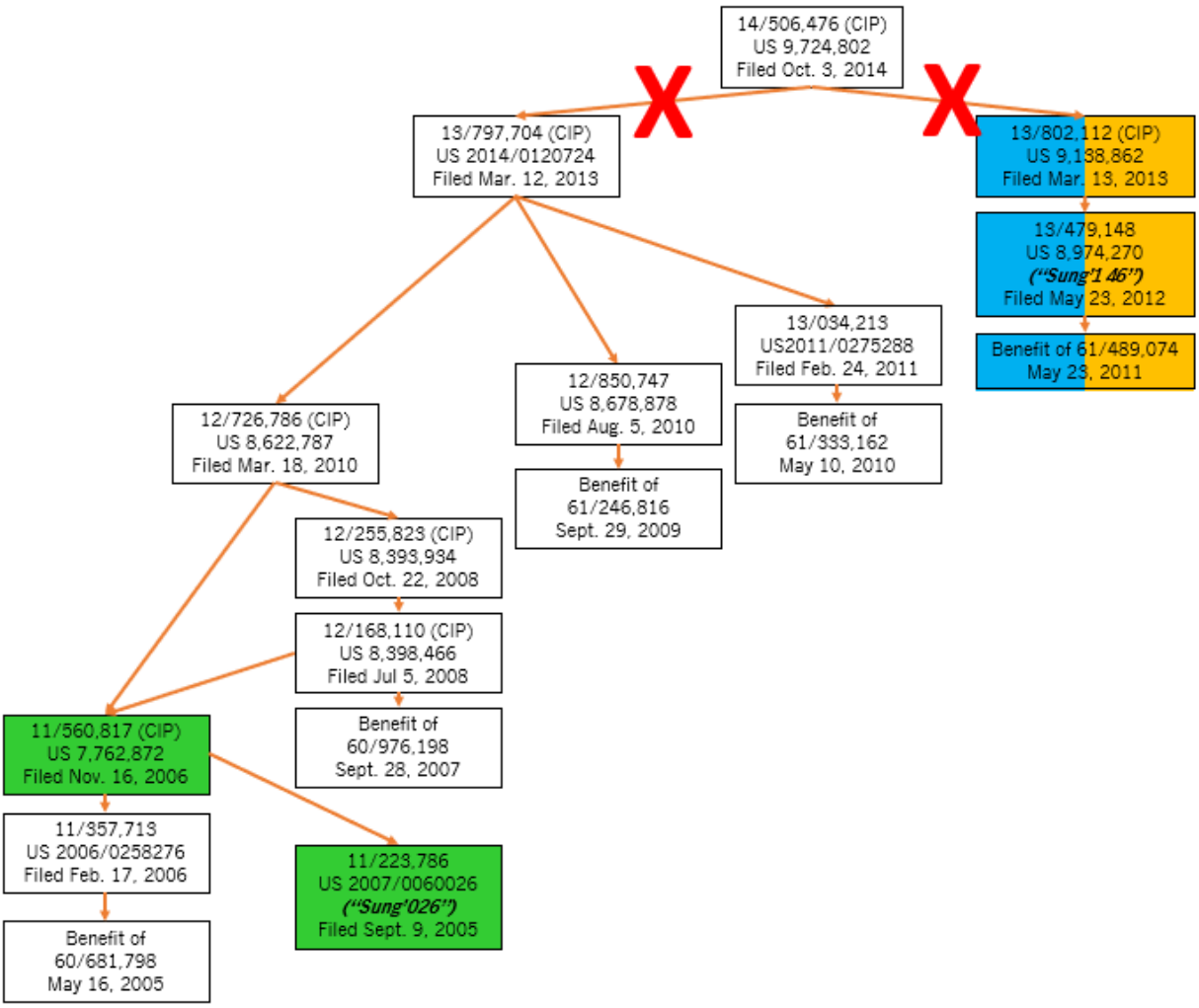
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and Kinik, bar Plaintiff from attempting to reclaim an earlier priority date. *See* MPEP § 211.02(a) (explaining that if an applicant intentionally waived the benefit claim to prior applications, the Office will reject applicants' later attempts to reclaim the earlier priority benefit).

Indeed, the '802 Patent is the first application that allegedly supports ***all*** limitations of Claim 1 (the sole independent claim from which all other claims depend). *See Studiengesellschaft Kohle, M.B.H. v. Shell Oil Co.*, 112 F.3d 1561, 1564 (Fed. Cir. 1997) ("35 U.S.C. § 120 requires an applicant to meet the disclosure requirement of § 112, ¶ 1 in a ***single*** parent application in order to obtain an earlier filing date for individual claims." (emphasis added)); *id.* at 1562 ("Because an applicant cannot combine multiple prior applications to obtain an earlier filing date for an individual claim, this court affirms the district court's invalidity holding."). For example, written description support for the following limitations of claim 1 is found only in different applications that are highlighted below using the corresponding colors:

- [1D]: "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"
- [1E]: "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"
- [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"

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Taking [1D] as an example, U.S. Patent Publ. No. 2007/0060026 ("Sung026") discloses that the "[p]lurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 5 microns to about 100 microns." Sung026, [0056]. However, such disclosure in Sung026 does not provide written description support for either [1E] or [1F].[4] Nor do Sung026's additional disclosures such as those identified below:

[4] But to be clear, these disclosures ***can*** anticipate [1E] and/or [1F] because disclosures such as "they are arranged such that their tips vary from the designated profile by less than about 1 micron" are species within the more broadly claimed genus. *See Vas-Cath Inc. v. Mahurkar,* 935 F.2d 1555, 1562 (Fed. Cir. 1991) ("The difference between 'claim-supporting disclosures' and 'claim-anticipating disclosures' was dispositive … 'the description of a single embodiment of broadly

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> In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 10 microns to about 75 microns[,] . . . by from about 10 microns to about 50 microns[,] . . . by from about 20 microns to about 50 microns[,] . . . by less than about 1 micron[].

Sung026, [0056].

Accordingly, the '802 Patent is entitled to a priority date no earlier than the filing date of the '802 Patent—October 3, 2014.

Additionally, and independently, dependent claims 6–12 of the '802 Patent are entitled to a priority date no earlier than the filing date of the '802 Patent—October 3, 2014—because the priority documents do not disclose the following claim limitations:

- "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" (Claim 6)
- "the cutting depth is from about 10 microns to about 50 microns" (Claim 7)
- "the plurality of working superabrasive particles includes at least 1000 working superabrasive particles" (Claim 9)
- "the plurality of working superabrasive particles includes from about 1000 to about 6000 working superabrasive particles" (Claim 10)
- "the plurality of working superabrasive particles includes from about 2000 to about 5000 working superabrasive particles" (Claim 11)
- "the plurality of working superabrasive particles include at least about 1000 working superabrasive particles that protrude from the rigid support substrate to distances within about 30 microns of one another" (Claim 12)

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claimed subject matter constitutes a description of the invention for anticipation purposes…, whereas the same information in a specification might not alone be enough to provide a description of that invention for purposes of adequate disclosure. …'").

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Accordingly, the ’802 Patent is entitled to a priority date no earlier than October 3, 2014, and is subject to the AIA version of the patent statutes.

III. IDENTIFICATION OF PRIOR ART AND INVALIDITY CLAIM CHARTS

Defendants contend that each Asserted Claim of the ’862 Patent is invalid under pre-AIA § 112, § 102, including subsections 102(a), 102(b), 102(e), and 102(g), and/or is invalid as obvious under pre-AIA § 103; and that each Asserted Claim of the ’802 Patent is invalid under AIA § 112, § 102, including subsections 102(a)(1) and 102(a)(2), and/or is invalid as obvious under AIA § 103. Moreover, each Asserted Claim of the ’802 Patent is invalid under pre-AIA § 112, § 102, including subsections 102(a), 102(b), 102(e), and 102(g), and/or is invalid as obvious under pre-AIA § 103, if the pre-AIA provisions of the patent laws were found to be applicable. For the ’802 Patent, the Invalidity Contentions may refer to the AIA provisions for simplicity, but it should be understood that Defendants’ contentions would equally apply under the pre-AIA provisions even if the pre-AIA provisions of the patent laws were found to be applicable, even if those provisions are not explicitly referenced.

Defendants herein identify prior art patents, printed publications, conference proceedings (or other disclosures), products and/or physical articles that anticipate and/or render obvious the Asserted Claims. Defendants reserve the right to rely on any of the references disclosed or incorporated by reference in these Invalidity Contentions, in the prior art identified below, the Asserted Patents and/or any related patents, in the file histories of the Asserted Patents and/or any related patents, and in the Exhibits attached to these Invalidity Contentions.

Detailed charts showing how each identified prior art reference anticipates and/or renders obvious each Asserted Claim are attached as Exhibits 862-1 through 862-12 and 802-1 through 802-13. Defendants’ invalidity claim charts may disclose multiple theories of invalidity in a single chart. For example, each chart directed to an anticipatory prior art reference also discloses how

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that reference, in combination with one or more other references and/or the knowledge of a POSITA, renders obvious one or more of the Asserted Claims. As another example, a chart may contain several embodiments or readings of a reference as applied to a specific limitation that anticipates and/or renders obvious the Asserted Claims.

Whenever an Exhibit includes a figure, diagram, table, or drawing, all of the text associated with that figure, diagram, table, or drawing is incorporated by reference (even if that text is not explicitly cited in the Exhibit). Similarly, if an Exhibit includes the text associated with a figure, diagram, table, or drawing, the described figure, diagram, table, or drawing is incorporated by reference (even if that figure, diagram, table, or drawing is not explicitly cited).

Although Defendants have identified at least one citation per limitation present in a reference or combination, Defendants do not necessarily identify each and every disclosure of the same or similar limitation in the same reference or combination. Moreover, although Defendants have provided at least one exemplary identification of the features in the prior art references that reads on certain claim limitations, Defendants do not necessarily identify each and every other possible mapping of the same or similar limitation in the same reference. To focus the issues, Defendants cite only particularly pertinent portions of the identified references, even where a reference or combination may contain additional disclosure of a particular claim element. Thus, Defendants may rely on uncited portions of the prior art references for additional disclosure of a particular element. Defendants may rely upon other prior art identified in future supplements, corroborating references, documentation, process recipes, source code, products, and testimony, including materials obtained through further investigation and third party discovery of the prior art identified herein, that demonstrates the invalidating disclosures identified in these Invalidity Contentions, or that shows the state of the art in the relevant time period (irrespective of whether

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such references themselves qualify as prior art to the Asserted Patents). Defendants may also rely on expert testimony to provide context to or aid in understanding the cited portions of the identified prior art.

Additionally, a POSITA generally reads a prior art reference as a whole and in the context of common knowledge, other publications, and literature. Numerous prior art references, including those identified herein and in the attached Exhibits, reflect common knowledge and the state, scope, and content of the prior art before the priority dates of the Asserted Claims of the Asserted Patents. Defendants may rely on uncited portions of the prior art references and on other publications and expert testimony to provide context and aid in understanding and interpreting the cited portions. The prior art references listed herein and in the accompanying invalidity claim charts may disclose the elements of the Asserted Claims explicitly or inherently. These prior art references are also relevant for showing the state of the art, as well as reasons and motivations for making improvements, additions, and combinations.

Defendants reserve the right to rely on inventor admissions concerning the scope of the prior art relevant to the Asserted Patents found in, *inter alia*, the prosecution history of the Asserted Patents and/or related patents/applications, any testimony or declarations of the named inventor concerning the Asserted Patents, related patents, patent applications, and/or the claimed inventions, and any papers or evidence submitted by Plaintiff in connection with the Asserted Patents or this litigation, any other future litigation brought by Plaintiff involving the Asserted Patents or related patents, *inter partes* review, or reexamination proceedings involving the Asserted Patents or related patents.

The following references, as explained further in Defendants' Exhibits and in this cover document, (1) anticipate and/or render obvious (alone, or in combination with other references, as

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set forth in detail in each claim chart and below) the Asserted Claims; and/or (2) provide background and context for the Asserted Claims.

A. Prior Art Patents and Patent Application Publications

The following prior art references, including those patent references listed in Exhibits 862-1 through 862-12 and 802-1 through 802-13, anticipate and/or render obvious the Asserted Claims of the Asserted Patents. In addition, Defendants incorporate by reference all prior art patents listed as prior art in the Asserted Patents.

Patent No. / Publication No.	**Country of Origin**	**Bates Number**	**Issue or Publication date**
CN202952160U ("Qiang")	China	SAMSUNG_CMS_000001-SAMSUNG_CMS_000008[5]	May 29, 2013
JP2006332322A ("Sakuri")	Japan	SAMSUNG_CMS_000009-SAMSUNG_CMS_000017 SAMSUNG_CMS_004603-SAMSUNG_CMS_004619	December 7, 2006
KR20100058234A ("Ju-ho")	Korea	SAMSUNG_CMS_000018-SAMSUNG_CMS_000031 SAMSUNG_CMS_004620-SAMSUNG_CMS_004627	September 20, 2011
KR100387954B1 ("Yoo")	Korea	SAMSUNG_CMS_007561-SAMSUNG_CMS_007571 SAMSUNG_CMS_007572-SAMSUNG_CMS_007591	June 19, 2003
TWM446063U ("Ye")	Taiwan	SAMSUNG_CMS_000033-SAMSUNG_CMS_000055 SAMSUNG_CMS_004628-SAMSUNG_CMS_004635	February 1, 2013
US10166653 ("Lee")	US	SAMSUNG_CMS_000056-SAMSUNG_CMS_000068	January 1, 2019

[5] A document (which may include multiple pages) is referenced using its first page's Bates number.

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
US10478941 ("Yoon")	US	SAMSUNG_CMS_000069-SAMSUNG_CMS_000095	November 19, 2019
US5036015 ("Sandhu")	US	SAMSUNG_CMS_000923-SAMSUNG_CMS_000929	July 30, 1991
US5314843 ("Yu")	US	SAMSUNG_CMS_006761-SAMSUNG_CMS_006771	May 24, 1994
US5429711 ("Watanabe")	US	SAMSUNG_CMS_000930-SAMSUNG_CMS_000944	July 4, 1995
US5527423 ("Neville")	US	SAMSUNG_CMS_007731-SAMSUNG_CMS_007746	June 18, 1996
US5695384 ("Beratan")	US	SAMSUNG_CMS_007726-SAMSUNG_CMS_007730	December 9, 1997
US6283836 ("Fruitman")	US	SAMSUNG_CMS_000945-SAMSUNG_CMS_000957	September 4, 2011
US6286498 ("Sung498")	US	SAMSUNG_CMS_000958-SAMSUNG_CMS_000974	September 11, 2001
US6346741 ("Van Buskirk")	US	SAMSUNG_CMS_006772-SAMSUNG_CMS_006787	February 12, 2002
US6500054 ("Ma")	US	SAMSUNG_CMS_000975-SAMSUNG_CMS_000983	December 31, 2002
US6524523 ("Jeng")	US	SAMSUNG_CMS_000984-SAMSUNG_CMS_000991	February 25, 2003
US6767409 ("Aoki")	US	SAMSUNG_CMS_000992-SAMSUNG_CMS_001007	July 27, 2004
US6849542 ("Katagiri")	US	SAMSUNG_CMS_001008-SAMSUNG_CMS_001023	February 1, 2005
US 6899592 to Kojima ("Kojima")	US	SAMSUNG_CMS_001024-SAMSUNG_CMS_001051	May 31, 2005
US6946397 ("Hong")	US	SAMSUNG_CMS_001052-SAMSUNG_CMS_001062	September 20, 2005
US7021995 ("Toge")	US	SAMSUNG_CMS_001063-SAMSUNG_CMS_001071	April 4, 2006
US7071108 ("Matsui")	US	SAMSUNG_CMS_001072-SAMSUNG_CMS_001110	July 4, 2006

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
US7097542 ("Skocypec")	US	SAMSUNG_CMS_001111-SAMSUNG_CMS_001122	August 29, 2006
US7201645 ("Sung645")	US	SAMSUNG_CMS_001123-SAMSUNG_CMS_001138	April 10, 2007
US7312158 ("Miyagawa158")	US	SAMSUNG_CMS_001139-SAMSUNG_CMS_001150	December 25, 2007
US7410411 ("Borucki")	US	SAMSUNG_CMS_001151-SAMSUNG_CMS_001166	August 12, 2008
US7677956 ("Carter")	US	SAMSUNG_CMS_001167-SAMSUNG_CMS_001173	March 16, 2010
US7678605 ("Schlueter")	US	SAMSUNG_CMS_007196-SAMSUNG_CMS_007206	March 16, 2010
US7741764 ("Sung764")	US	SAMSUNG_CMS_001174-SAMSUNG_CMS_001183	June 22, 2010
US7762872 ("Sung872")	US	SAMSUNG_CMS_001184-SAMSUNG_CMS_001201	July 27, 2010
US854777 ("Takemiya")	US	SAMSUNG_CMS_001202-SAMSUNG_CMS_001213	December 21, 2010
US8026179 ("Lue")	US	SAMSUNG_CMS_001214-SAMSUNG_CMS_001227	September 27, 2011
US8096852 ("Deshpande")	US	SAMSUNG_CMS_001228-SAMSUNG_CMS_001238	January 17, 2012
US8342910 ("Dinh-Ngoc")	US	SAMSUNG_CMS_001239-SAMSUNG_CMS_001285	January 1, 2013
US8393934 ("Sung934")	US	SAMSUNG_CMS_001286-SAMSUNG_CMS_001302	March 12, 2013
US8398466 ("Sung466")	US	SAMSUNG_CMS_001303-SAMSUNG_CMS_001320	March 19, 2013
US8431449 ("Sung449")	US	SAMSUNG_CMS_001321-SAMSUNG_CMS_001363	April 30, 2013
US8550879 ("Chen")	US	SAMSUNG_CMS_001364-SAMSUNG_CMS_001374	October 8, 2013
US7641538 ("Goers538")	US	SAMSUNG_CMS_007187-SAMSUNG_CMS_007195	Jan. 5, 2010

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
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US7960802 (“Niimi”)	US	SAMSUNG_CMS_007207-SAMSUNG_CMS_007221	Jun. 14, 2011
US8592314 (“Nishioka”)	US	SAMSUNG_CMS_001375-SAMSUNG_CMS_001386	November 26, 2013
US8597081 (“Choi”)	US	SAMSUNG_CMS_001387-SAMSUNG_CMS_001399	December 3, 2013
US8657652 (“Hwang”)	US	SAMSUNG_CMS_001400-SAMSUNG_CMS_001410	February 25, 2014
US8721395 (“Wu395”)	US	SAMSUNG_CMS_001411-SAMSUNG_CMS_001428	May 13, 2014
US8801497 (“Schwappach”)	US	SAMSUNG_CMS_001429-SAMSUNG_CMS_001508	August 12, 2014
US8951099 (“Wu099”)	US	SAMSUNG_CMS_001509-SAMSUNG_CMS_001523	February 10, 2015
US9132526 (“Smith526”)	US	SAMSUNG_CMS_001524-SAMSUNG_CMS_001548	September 15, 2015
US9314901 (“Lee901”)	US	SAMSUNG_CMS_001549-SAMSUNG_CMS_001561	April 19, 2016
US9421668 (“Lee668”)	US	SAMSUNG_CMS_001562-SAMSUNG_CMS_001574	August 23, 2016
US7394116 (“Kim”)	US	SAMSUNG_CMS_007146-SAMSUNG_CMS_007186	Jul.1, 2008
US5522965 (“Chisholm”)	US	SAMSUNG_CMS_007099-SAMSUNG_CMS_007104	Jun. 4, 1996
US8329587 (“Liang”)	US	SAMSUNG_CMS_007222-SAMSUNG_CMS_007236	Dec. 11, 2012
US9616547 (“Smith547”)	US	SAMSUNG_CMS_001575-SAMSUNG_CMS_001599	April 11, 2017
US6699299 (“Sachan”)	US	SAMSUNG_CMS_007140-SAMSUNG_CMS_007145	Mar. 2, 2004
WO00/63963 (“Laursen”)	PCT	SAMSUNG_CMS_001624-SAMSUNG_CMS_001644	October 26, 2000

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
Non-Abrasive Conditioning for Polishing Pads			
WO2008/036892 ("Puthanangady") Conditioning Tools & Techniques for Chemical Mechanical Planarization	PCT	SAMSUNG_CMS_001645-SAMSUNG_CMS_001678	March 27, 2008
WO2008/049019 ("Lin") Copper Deposition for Filling Features in Manufacture of MicroElectric Devices	PCT	SAMSUNG_CMS_001679-SAMSUNG_CMS_001722	April 24, 2008
WO2012/122186 ("Smith") Chemical Mechanical Planarization Pad Conditioner	PCT	SAMSUNG_CMS_001723-SAMSUNG_CMS_001777	September 13, 2012
WO2000044034A1 ("Gotkis") Methods & Cleaning Solutions for Post-Chemical Mechanical Polishing	PCT	SAMSUNG_CMS_006813-SAMSUNG_CMS_006836	July 27, 2000
US20020173234 ("Sung324") Diamond Grid CMP Pad Dresser	US	SAMSUNG_CMS_000129-SAMSUNG_CMS_000141	Nov. 21, 2002
US2002/0182401 ("Lawing") Pad Conditioner with Uniform Particle Height	US	SAMSUNG_CMS_000142-SAMSUNG_CMS_000155	December 5, 2002
US20060276111 ("Tian")	US	SAMSUNG_CMS_006734-SAMSUNG_CMS_006744	Dec. 7, 2006

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
Conditioning Element for Electrochemical Mechanical Processing			
US2003/0084894 ("Sung894") Brazed Diamond Tools & Methods for Making the Same	US	SAMSUNG_CMS_000156-SAMSUNG_CMS_000186	May 8, 2003
US2003/0109204 ("Sung204") Fixed Abrasive CMP Pad Dresser & Associated Methods	US	SAMSUNG_CMS_000187-SAMSUNG_CMS_000197	June 12, 2003
US2007/0117394 ("Shinoda") Polishing Slurry for CMP and Polishing Method	US	SAMSUNG_CMS_006745-SAMSUNG_CMS_006760	May 24, 2007
US2004/0159050 ("Pasqualoni") Chemical Mechanical Polishing Slurry Composition for Polishing	US	SAMSUNG_CMS_000198-SAMSUNG_CMS_000205	August 19, 2004
US2006/0079162 ("Yamashita") CMP Conditioner	US	SAMSUNG_CMS_000206-SAMSUNG_CMS_000216	Sep. 22, 2004
US2006/0216938 ("Miyagawa") Method of forming pattern	US	SAMSUNG_CMS_007620-SAMSUNG_CMS_007630	September 28, 2006
US2006/027611 ("Tian") Conditioning Element for Electrochemical Mechanical Processing	US	SAMSUNG_CMS_000228-SAMSUNG_CMS_000238	December 7, 2006

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
US2007/0000872 ("Matsui872") Method for Chemically Mechanically Polishing Organic Film, Method of Manufacturing Semiconductor Device, and Program Therefor	US	SAMSUNG_CMS_000239-SAMSUNG_CMS_000257	January 4, 2007
US2007/0004210 ("Takemiya") Polishing Composition & Polishing Method	US	SAMSUNG_CMS_000258-SAMSUNG_CMS_000269	January 4, 2007
US2007/0037493 ("Shih") Pad Conditioner for Conditioning a CMP Pad & Method of Making Such a Pad Conditioner	US	SAMSUNG_CMS_000270-SAMSUNG_CMS_000275	February 15, 2007
US2007/0060026 ("Sung026") Methods of Bonding Super Abrasive Particles in an Organic Matrix	US	SAMSUNG_CMS_000276-SAMSUNG_CMS_000293	March 15, 2007
US2007/0077874 ("Ataka") Flexible Materials Processing Rotation Tool	US	SAMSUNG_CMS_000294-SAMSUNG_CMS_000311	April 5, 2007
US2007/0128994 ("Sung994") Electoplated Abrasive Tools, Methods, & Molds	US	SAMSUNG_CMS_000312-SAMSUNG_CMS_000323	June 7, 2007

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
US2007/0155298 ("Kinik298") Super Hard Cutters & Associated Methods	US	SAMSUNG_CMS_000324-SAMSUNG_CMS_000341	July 5, 2007
US2007/0218821 ("Nonoshita") CMP Pad Conditioner	US	SAMSUNG_CMS_000342-SAMSUNG_CMS_000346	September 20, 2007
US2011/0097977 ("Bubnick")	US	SAMSUNG_CMS_007076-SAMSUNG_CMS_007098	Apr. 28, 2011
US2006/0010780 ("Hall") Abrasive Tools Made With a Self-Avoiding Abrasive Grain Array	US	SAMSUNG_CMS_007042-SAMSUNG_CMS_007057	Jan. 19, 2006
US6054183 ("Goers183")	US	SAMSUNG_CMS_007115-SAMSUNG_CMS_007133	Apr. 25, 2000
US2007/0254566 ("Sung566") Contoured CMP Pad Dresser & Associated Methods	US	SAMSUNG_CMS_000347-SAMSUNG_CMS_000362	November 1, 2007
US2008/0001215 ("Jung") Semiconductor Device Having Recess Gate & Method of Fabricating the Same	US	SAMSUNG_CMS_000363-SAMSUNG_CMS_000371	January 3, 2008
US2008/0004743 ("Goers743") Abrasive Articles, CMP Monitoring System, and Method	US	SAMSUNG_CMS_000372-SAMSUNG_CMS_000387	January 3, 2008
US2008/0054341 ("Natori") "Semiconductor memory device and	US	SAMSUNG_CMS_007631-SAMSUNG_CMS_007656	March 6, 2008

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
method for manufacturing same"			
US2008/0087644 ("Nishioka") Polishing Composition & Polishing Method	US	SAMSUNG_CMS_000388-SAMSUNG_CMS_000400	April 17, 2008
US2008/0096479 ("Sung479") Low-Melting Point Superabrasive Tools & Associated Methods	US	SAMSUNG_CMS_000401-SAMSUNG_CMS_000415	April 24, 2008
US2008/0271384 ("Puthanangady384") Conditioning Tools & Techniques for Chemical Mechanical Planarization	US	SAMSUNG_CMS_000416-SAMSUNG_CMS_000428	November 6, 2008
US2008/0292869 ("Kinik869") Methods of Bonding Superabrasive Particles in an Organic Matrix	US	SAMSUNG_CMS_000429-SAMSUNG_CMS_000443	November 27, 2008
US2009/0001581 ("Kim") Metal Line of Semiconductor Device & Method of Forming the Same	US	SAMSUNG_CMS_000444-SAMSUNG_CMS_000453	January 1, 2009
US2009/0038234 ("Yen") Pad Conditioner & Method for Making the Same	US	SAMSUNG_CMS_000454-SAMSUNG_CMS_000474	February 12, 2009
US2009/0042494 to Moon ("Moon")	US	SAMSUNG_CMS_000475-SAMSUNG_CMS_000502	February 12, 2009

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
US2010/0285409 ("Tanaka") Method for manufacturing semiconductor device	US	SAMSUNG_CMS_007657-SAMSUNG_CMS_007672	November 11, 2010
US2011/0024825 ("Izumi") Semiconductor memory	US	SAMSUNG_CMS_007673-SAMSUNG_CMS_007725	February 3, 2011
US2011/0073094 ("Tselesin")	US	SAMSUNG_CMS_007058-SAMSUNG_CMS_007075	Marc. 31, 2011
US2004/0033690 ("Schowalter")	US	SAMSUNG_CMS_007031-SAMSUNG_CMS_007041	Feb. 19, 2004
US5602423 ("Jain")	US	SAMSUNG_CMS_007105-SAMSUNG_CMS_007114	Feb. 11, 1997
US2009/0117692 ("Koyama") Manufacturing Method of Semiconductor Device	US	SAMSUNG_CMS_000503-SAMSUNG_CMS_000567	May 7, 2009
US2009/0145045 ("Sung045") Methods for Orienting Superabrasive Particles on a Surface & Associated Tools	US	SAMSUNG_CMS_000568-SAMSUNG_CMS_000577	June 11, 2009
US2009/0221216 ("Fujita") Pad Dresser, Polishing Device, & Pad Dressing Method	US	SAMSUNG_CMS_000578-SAMSUNG_CMS_000610	September 3, 2009
US2009/0224370 ("Slutz") Non-Planar CVD Diamond-Coated CMP Pad Conditioner &	US	SAMSUNG_CMS_000611-SAMSUNG_CMS_000637	September 10, 2009

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
Method for Manufacturing			
US2010/0009540 ("Kamiya") Polishing Compound, Its Production Process and Polishing Method	US	SAMSUNG_CMS_000638-SAMSUNG_CMS_000648	January 14, 2010
US2010/0015898 ("An") Conditioner for Chemical Mechanical Planarization Pad	US	SAMSUNG_CMS_000649-SAMSUNG_CMS_000663	January 21, 2010
US2010/0022174 to Chou ("Chou") Grinding Tool & Method for Fabricating the Same	US	SAMSUNG_CMS_000664-SAMSUNG_CMS_000674	January 28, 2010
US2010/0221990 ("Sung990")	US	SAMSUNG_CMS_000675-SAMSUNG_CMS_000690	September 2, 2010
US2010/0248595 ("Dinh-Ngoc") Abrasive Tool for Use as a Chemical Mechanical Planarization Pad Conditioner	US	SAMSUNG_CMS_000691-SAMSUNG_CMS_000736	September 30, 2010
US2010/0291840 ("Huang") System & Method for Conditioning Chemical Mechanical Polishing Apparatus Using Multiple Conditioning Disks	US	SAMSUNG_CMS_000737-SAMSUNG_CMS_000744	November 18, 2010
US2010/0330886 ("Wu886") Corrosion-Resistant CMP Conditioning	US	SAMSUNG_CMS_000745-SAMSUNG_CMS_000761	December 30, 2010

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
Tools & Methods for Making & Using Same			
US2011/0239444 ("Fukuoka") Method of Manufacturing Lapping Plate, and Method of Manufacturing Magnetic Head Slider Using the Lapping Plate	US	SAMSUNG_CMS_000762-SAMSUNG_CMS_000775	October 6. 2011
US2011/0250826 ("Yoon") Pad Conditioner Having Reduced Friction & Method of Manufacturing the Same	US	SAMSUNG_CMS_000776-SAMSUNG_CMS_000801	October 13, 2011
US2012/0149287 ("Wu287") Chemical Mechanical Planarization (CMP) Pad Conditioner & Method of Making	US	SAMSUNG_CMS_000802-SAMSUNG_CMS_000811	June 14, 2012
US2012/0171935 ("Ruland") CMP Pad Conditioning Tool	US	SAMSUNG_CMS_000812-SAMSUNG_CMS_000824	July 5, 2012
US2012/0292735 ("Tan") Corner Transistor Suppression	US	SAMSUNG_CMS_000825-SAMSUNG_CMS_000835	November 22, 2012
US2012/0302146 ("Sung146") CMP Pad Dresser Having Leveled Tips & Associated Methods	US	SAMSUNG_CMS_000836-SAMSUNG_CMS_000848	November 29, 2012
US2012/0322348 ("Yokoi")	US	SAMSUNG_CMS_000849-SAMSUNG_CMS_000864	December 20, 2012

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
Pad for Chemical Mechanical Polishing and Method of Chemical Mechanical Polishing Using Same			
US2013/0344779 ("Lee779") Conditioner for Soft Pad & Method for Manufacturing Same	US	SAMSUNG_CMS_000865-SAMSUNG_CMS_000872	December 26, 2013
US2014/0094101 ("Lee101") CMP Pad Conditioner, and Method for Producing the CMP Pad Conditioner	US	SAMSUNG_CMS_000873-SAMSUNG_CMS_000884	April 3, 2014
US2014/0120809 ("Qian") Soft & Conditionable Chemical Mechanical Polishing Pad	US	SAMSUNG_CMS_000885-SAMSUNG_CMS_000894	May 1, 2014
US2014/0127983 ("Wang") Chemical Mechanical Polishing Conditioner & Manufacturing Methods Thereof	US	SAMSUNG_CMS_000895-SAMSUNG_CMS_000904	May 8, 2014
US2016/0114460 ("Chao") Method of Forming Diamond Conditioners for CMP Process	US	SAMSUNG_CMS_000905-SAMSUNG_CMS_000913	April 28, 2016
JP2006332322A ("Sakurai")	JP	SAMSUNG_CMS_006998-SAMSUNG_CMS_007002 SAMSUNG_CMS_007003-SAMSUNG_CMS_007011	Dec. 7, 2006

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Patent No. / Publication No.	Country of Origin	Bates Number	Issue or Publication date
JP2002046058A ("Koichi")	JP	SAMSUNG_CMS_007012-SAMSUNG_CMS_007016 SAMSUNG_CMS_007017-SAMSUNG_CMS_007026	Feb. 12, 2002
JP2005335016A ("Uneo")	JP	SAMSUNG_CMS_006976-SAMSUNG_CMS_006983 SAMSUNG_CMS_006984-SAMSUNG_CMS_006997	July 25, 2012
JP2003260656A ("Sieshi")	JP	SAMSUNG_CMS_006968-SAMSUNG_CMS_006975	Sept. 16, 2003
CN202952160 ("Tang")	CN	SAMSUNG_CMS_000001-SAMSUNG_CMS_000008 SAMSUNG_CMS_004598-SAMSUNG_CMS_004602	Mar. 07, 2011

B. Non-Patent Literature Publications

The following prior art publications, including those publications listed in Exhibits 862-1 through 862-12 and 802-1 through 802-13, anticipate and/or render obvious the Asserted Claims of the Asserted Patents. In addition, Defendants incorporate by reference all prior art publications listed as prior art in the Asserted Patents.

Title	Author / Publisher	Bates Number	Date of Publication
Study on Improving the CMP Performance by Various Pad Conditioner Designs & Fixed Nanodiamond Pad	Cheng-Yi Shih	SAMSUNG_CMS_004748-SAMSUNG_CMS_004941	2010
CMP Conditioner &	Len Borucki	SAMSUNG_CMS_004942-SAMSUNG_CMS_004981	2008

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Title	Author / Publisher	Bates Number	Date of Publication
Pad Characterization			
The Dressing of Pads for CMP of Next Generation Wafers	James Sung, et al.	SAMSUNG_CMS_004982-SAMSUNG_CMS_005022	April 9, 2008
The Design Features of Organic and Polycrystalline Metal Free Diamond Disks ("CMPUG2009")	Michael Sung	SAMSUNG_CMS_005023-SAMSUNG_CMS_005051	May 6, 2009
Characteristics of a Novel CVD Diamond Pad Conditioner	R.K. Singh, et al.	SAMSUNG_CMS_005052-SAMSUNG_CMS_005069	May 15, 2013
A Test Methodology for Comparing the Performance of CMP Conditioners	David Slutz	SAMSUNG_CMS_005070-SAMSUNG_CMS_005087	July 10, 2013
Pad Conditioning Effects in Chemical Mechanical Polishing	A. Scott Lawing	SAMSUNG_CMS_006709-SAMSUNG_CMS_006729	May 5, 2004
Evolution of CMP Pad Conditioners & Abrasive Technology's Leadership Role ("CMPUG2005")	Northern California Chapter of the American Vacuum Society	SAMSUNG_CMS_005118-SAMSUNG_CMS_005137	June 1, 2005
PolyCrystalline Diamond Conditioners for Dressing CMP	James Sung, et al.	SAMSUNG_CMS_005138-SAMSUNG_CMS_005151	April 12, 2006

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Title	Author / Publisher	Bates Number	Date of Publication
Pads: An Enabling Technology for Manufacturing Future Semiconductor Devices			
Study on Stiffness & Conditioning Effects of CMP Pad Based on Physical Die-Level CMP Model	Wei Fan, et al.	SAMSUNG_CMS_005152-SAMSUNG_CMS_005160	April 1, 2010
Pad Conditioning Density Distribution in CMP Process with Diamond Dresser	Tyan Feng	SAMSUNG_CMS_005161-SAMSUNG_CMS_005172	November 2007
Link Between Silica-metal Agglomeration and High Porosity Ultra-Low K Scratch Formation During Chemical Mechanical Polishing	Nancy Heylen	SAMSUNG_CMS_005173-SAMSUNG_CMS_005175	2010
PCD Dressers for Chemical Mechanical Planarization with Uniform Polishing ("Ishizuka")	Hiroshi Ishizuka, et al.	SAMSUNG_CMS_005182-SAMSUNG_CMS_005187	November 7, 2007
A Study of the Characteristics of the Diamond Dresser in the	Y.S. Liao, et al.	SAMSUNG_CMS_005552-SAMSUNG_CMS_005557	February 15, 2004

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Title	Author / Publisher	Bates Number	Date of Publication
CMP Process("Liao")			
Single Diamond Dressing Characteristics of CMP Polyurethane Pad	Y.S. Liao, et al.	SAMSUNG_CMS_005558-SAMSUNG_CMS_005564	January 15, 2007
A Dictionary of Weights, Measures, & Units	Donald Fenna	SAMSUNG_CMS_005565-SAMSUNG_CMS_005569	2004
Novel CVD Diamond-coated Conditioner for Improved Performance in CMP Processes	Youn-Chul Kim, et al.	SAMSUNG_CMS_005574-SAMSUNG_CMS_005577	February 16, 2011
Investigation of Pad Surface Topography Distribution for Material Removal Uniformity in CMP Process	Kihyun Park, et al.	SAMSUNG_CMS_005578-SAMSUNG_CMS_005586	June 24, 2008
Generation of Pad Debris during Oxide CMP Process and Its Role in Scratch Formation	Y. Nagendra Prasad	SAMSUNG_CMS_005587-SAMSUNG_CMS_005594	February 23, 2011
Design, Characteristics and Performance of Diamond Pad Conditioners	Doug Pysher	SAMSUNG_CMS_005595-SAMSUNG_CMS_005602	August 1, 2010
Reduction Of Micro-Defects in	Sung-Woo Park, et al.	SAMSUNG_CMS_005603-SAMSUNG_CMS_005606	Nov. 2001

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Title	Author / Publisher	Bates Number	Date of Publication
the Inter-Metal Dielectrics (IMD) Chemical Mechanical Polishing (CMP) For ULSI Applications			
Advanced FD System for COC Reduction and Quality Improvement by Using Pad Height Sensor for CMP Process	Katsuhisa Sakai, et al.	SAMSUNG_CMS_007027-SAMSUNG_CMS_007030	2010
Polycrystalline Diamond (PCD) Shaving Dresser: The Ultimate Diamond Disk (UDD) for CMP Pad Conditioning	James Sung	SAMSUNG_CMS_005736-SAMSUNG_CMS_005742	2009
The Fabrication of Ideal Diamond Disk (IDD) by Casting Diamond Film on Silicon Wafer	James Sung	SAMSUNG_CMS_005743-SAMSUNG_CMS_005748	October 25-27, 2007
The Design Features of Ultimate Diamond Disks (UDD): W CMP with In-Situ Dressing of Metal Free Diamond Disks	James Sung, et al.	SAMSUNG_CMS_005749-SAMSUNG_CMS_005755	2009

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Title	Author / Publisher	Bates Number	Date of Publication
Mosaic Diamond Pad Conditioners for Improved CMP Performance	James Sung, et al.	SAMSUNG_CMS_005756-SAMSUNG_CMS_005762	2010
The Pad Dressing Phenomena of Multiple Diamond Grits: Implications for the Design of CMP Pad Conditioners	James Sung, et al.	SAMSUNG_CMS_005763-SAMSUNG_CMS_005769	2010
PCD Pad Conditioners for Low Pressure Chemical Mechanical Planarisation of Semiconductors ("Kinik2008")	James Sung, et al.	SAMSUNG_CMS_005770-SAMSUNG_CMS_005798	2008
The Organic Diamond Disk (ODD) for Dressing Polishing Pads of Chemical Mechanical Planarization	James Sung, et al.	SAMSUNG_CMS_005799-SAMSUNG_CMS_005804	October 27, 2007
Cermet Ceramic Coating on Diamond Dresser for In-Situ Dressing of Chemical	James Sung, et al.	SAMSUNG_CMS_006837-SAMSUNG_CMS_006840	2005
Technological Breakthrough in Pad Life Improvement and its Impact on CMP CoC	Sidney Huey	SAMSUNG_CMS_005805-SAMSUNG_CMS_005809	1999

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Title	Author / Publisher	Bates Number	Date of Publication
Investigation of a Novel Diamond Disk's Effect on Pad Topography in Oxide Chemical Mechanical Polishing	Ming-Yi Tsai, et al.	SAMSUNG_CMS_005810-SAMSUNG_CMS_005819	June 19, 2010
Organic Diamond Disk Versus Brazed Diamond Disk for Dressing a Chemical–mechanical Polishing Pad	M.Y. Tsai, et al.	SAMSUNG_CMS_005820-SAMSUNG_CMS_005825	January 10, 2012
Novel Diamond Conditioner Dressing Characteristics of CMP Polishing Pad	Ming-Yi Tsai, et al.	SAMSUNG_CMS_005826-SAMSUNG_CMS_005833	March 20, 2009
Effect Of CMP Conditioner Diamond Shape on Pad Topography and Oxide Wafer Performances	Ming-Yi Tsai, et al.	SAMSUNG_CMS_005834-SAMSUNG_CMS_005843	March 26, 2010
Chemical Mechanical Planarization: Study of Conditioner Abrasives and Synthesis of Nano-Zirconia for Potential Slurry Applications	Chhavi Manocha	SAMSUNG_CMS_006841-SAMSUNG_CMS_006953	Oct. 31, 2008

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Title	Author / Publisher	Bates Number	Date of Publication
New CMP Pad Conditioners with Increased Number of Diamond Tips for Longer Dressing Life	Zongqing Yang, et al.	SAMSUNG_CMS_006036-SAMSUNG_CMS_006044	2014
Diamond Disc Diagnostic Method Based on "Dry" Coefficient of Friction Measurements	Anand Meled, et al.	SAMSUNG_CMS_006730-SAMSUNG_CMS_006733	October 1, 2010
Reduced Cost of Ownership Copper CMP Process using Third Generation Low Abrasive Selective Slurry	Christopher Bannon	SAMSUNG_CMS_006954-SAMSUNG_CMS_006962	2011
Effects of Diamond Shape and Size on Polyurethane Pad Conditioning	Mark Bubnick et al.	AT000131	2004
Evaluation of an Ultra-Flat Ceramic Based CMP Conditioning Disk ("AT2006")	McGregor et al.	AT000137	2006
Copper Interconnect Technology for the 32 nm Node and Beyond	Jeff Gambino et al.	SAMSUNG_CMS_007592-SAMSUNG_CMS_007599	October 9, 2009
"Evolution of CMP Pad Conditioners &	Abrasive Technology	SAMSUNG_CMS_007600-SAMSUNG_CMS_007619	June 1, 2005

[redacted]

Title	Author / Publisher	Bates Number	Date of Publication
Abrasive Technology's Leadership Role"			

C. Product Prior Art

Defendants contend that each Asserted Claim of the '862 Patent is invalid in view of product prior art under pre-AIA § 102, including subsections 102(a), 102(b), and 102(g), and/or under pre-AIA § 103; and that each Asserted Claim of the '802 Patent is invalid in view of product prior art under AIA § 102, including subsection 102(a), and/or under AIA § 103. Moreover, each Asserted Claim of the '802 Patent is invalid in view of product prior art under pre-AIA § 102, including subsections 102(a), 102(b), and 102(g), and/or under pre-AIA § 103, if the pre-AIA provisions of the patent laws were found to be applicable.

The following lists each item of product prior art for the '862 Patent and the '802 Patent, by the name of the item and, to the extent now known, when the item became publicly known or was used, offered for sale, or sold, the identities of the persons or entities that made the item public, publicly used it, or made the offer for sale, and the identities of the person(s) or entities involved in, and the circumstances surrounding the making of, the product prior art.

Defendants contend that some of the following descriptions may be on information and belief and are supported by the information and documents that will be produced by Defendants or third parties. As discovery is not yet complete, Defendants list of prior art below is not complete or exhaustive but is based on information currently available without the benefit of complete discovery. Thus, Defendants continue to investigate these and additional prior art products and reserve the right to amend the following list as information becomes known to them.

[redacted]

1. Saesol CMP Pad Conditioner ("Saesol PA")

Saesol Diamond Co. Ltd. ("Saesol") is a CMP pad conditioner manufacturer headquartered in South Korea. Saesol's CMP pad conditioners have been imported into or sold in the United States and around the world, since at least 1999. As used herein, "Saesol CMP Pad Conditioner" ("Saesol PA" in short) refers to CMP pad conditioners developed, manufactured, fabricated, or supplied in the United States, and around the world, by Saesol before the respective priority dates of the Asserted Patents.

For example, Saesol PA was known or used by others in the United States, in public use, on sale, offered for sale in the United States, and/or made by another in the United States who had not abandoned, suppressed, or concealed it before the priority date of the '862 Patent, and is thus prior art to the '862 Patent under pre-AIA §§ 102(a), (b), and/or (g)(2); Saesol PA was in public use, on sale, offered for sale, and/or otherwise available to the public before the priority date of the '802 Patent, and is thus prior art to the '802 Patent under AIA § 102[6].

Examples of Saesol PA include—but are not limited to—at least the following CMP pad dressers.

a. 4DNS80AMC1

The disc identified by the name 4DNS80AMC1 is a CMP pad conditioner developed by Saesol. SAMSUNG_CMS_007331 ("Saesol Analysis"). As early as [redacted] and possibly earlier, 4DNS80AMC1 was designed, developed, manufactured, used, and/or sold around the world, including in the United States. For example, Saesol has sold 4DNS80AMC1 to customers around the world, including those in the United States, such as [redacted]

[6] To the extent the '802 Patent is determined to be entitled to a priority date earlier than March 16, 2013, the pre-AIA version of § 102 governs, including pre-AIA §§ 102(a), (b), and/or (g)(2). Even under the pre-AIA provisions of the patent laws, Defendants' invalidity contentions would apply based on prior art identified herein.

[redacted], from [redacted]. *See* Saesol-SS-000731; Saesol-SS-000569; Saesol-SS-000672; Saesol-SS-000582. Indeed, a physical article of 4DNS80AMC1, shown below with a serial number 0602020917, was delivered to the United States before June 5, 2006.



Accordingly, Saesol's 4DNS80AMC1 is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent. *See also* Saesol-SS-000557–Saesol-SS-000725; Saesol-SS-000731-Saesol-SS-000764; Saesol Analysis.

b. HLPX-MD08_M (A.K.A. HLPX-DH3661 or LPX-DH3661)

Saesol designed, developed, manufactured, used, and/or sold a Saesol CMP pad dresser identified by the part number HLPX-MD08_M since at least [redacted]. For example, Saesol sold [redacted]. Saesol-SS-000001. Accordingly, HLPX-

[redacted]

MD08_M is prior art under at least AIA §§ 102(a)(1) against the '802 Patent. Saesol-SS-000001–Saesol-SS-000165; Saesol-SS-000174–Saesol-SS-000179.

c. EK45_AM13BSL8031C1-PMF_24

Saesol designed, developed, manufactured, used, and/or sold a Saesol CMP pad dresser identified by the part number EK45_AM13BSL8031C1-PMF_24 since [redacted]. For example, Saesol sold EK45_AM13BSL8031C1-PMF_24 to [redacted] Saesol-SS-000180; Saesol-SS-000183. Accordingly, EK45_AM13BSL8031C1-PMF_24 is prior art under at least AIA §§ 102(a)(1) against the '802 Patent. Saesol-SS-000180–Saesol-SS-000298; Saesol-SS-000308–Saesol-SS-000350.

d. AM32R80C1-MF

Saesol designed, developed, manufactured, used, and/or sold AM32R80C1-MF before the respective priority dates of the Asserted Patents. For example, as of [redacted], Saesol had already designed, developed, manufactured, and used AM32R80C1-MF (e.g., with the lot number [redacted]). SAMSUNG_CMS_007237. Accordingly, Saesol's AM32R80C1-MF is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

* * *

For the reasons provided below, Saesol PA invalidates every Asserted Claims of the Asserted Patents. Saesol-SS-000001– Saesol-SS-000808; Saesol Analysis.

2. Shinhan CMP Pad Conditioner ("Shinhan PA")

Shinhan Diamond Industrial Co. Ltd. ("Shinhan") is a CMP pad conditioner manufacturer headquartered in South Korea. Shinhan's CMP pad conditioners have been imported into or sold in the United States, and around the world. As used herein, "Shinhan CMP Pad Conditioner" ("Shinhan PA" in short) refers to CMP pad conditioners developed, manufactured, fabricated, or

[redacted]

supplied in the United States, and around the world, by Shinhan before the respective priority dates of the Asserted Patents.

For example, Shinhan PA was known or used by others in the United States, in public use, on sale, offered for sale in the United States, and/or made by another in the United States who had not abandoned, suppressed, or concealed it before the priority date of the '862 Patent, and is thus prior art to the '862 Patent under pre-AIA §§ 102(a), (b), and/or (g)(2); Shinhan PA was in public use, on sale, offered for sale, and/or otherwise available to the public before the priority date of the '802 Patent, and is thus prior art to the '802 Patent under AIA § 102[7].

Examples of Shinhan PA include—but are not limited to—at least the following CMP pad dressers.

a. PNC01D

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the model name PNC01D around the world, including in the United States, before 2009. SAMSUNG_CMS_007427 ("Shinhan Analysis"). Accordingly, Shinhan's PNC01D is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

b. 99102

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the part number 99102 as early as [redacted]. For example, 99102 was sold around the world, including in the United States, at least as early as [redacted]. SHINHAN00000759. Accordingly, 99102 is prior art under at least pre-AIA §§ 102(a) and 102(b)

[7] To the extent the '802 Patent is determined to be entitled to a priority date earlier than March 16, 2013, the pre-AIA version of § 102 governs, including pre-AIA §§ 102(a), (b), and/or (g)(2). Even under the pre-AIA provisions of the patent laws, Defendants' invalidity contentions would apply based on prior art identified herein.

[redacted]

against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

c. CMP-E-M49-AC

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the part number CMP-E-M49-AC as early as 2013. Accordingly, CMP-E-M49-AC is prior art under at least AIA §§ 102(a)(1) against the ’802 Patent.

d. 99561

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the part number 99561 as early as [redacted] For example, Shinhan sold 99561 at least as early as [redacted]. SHINHAN00000759. Accordingly, 99561 is prior art under at least AIA §§ 102(a)(1) against the ’802 Patent.

e. 99004

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the part number 99004 around the world, including in the United States, as early as [redacted]. For example, Shinhan sold 99004 in the United States at least as early as [redacted] SHINHAN00000759; SHINHAN00000682–SHINHAN00000685; SHINHAN00000636–SHINHAN00000639; SHINHAN00000642–SHINHAN00000653; SHINHAN00000691. Accordingly, 99004 is prior art under at least pre-AIA § 102(a) against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent. and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

f. 99086

Shinhan designed, developed, manufactured, used, and/or sold a Shinhan CMP pad dresser identified by the part number 99086 around the world, including in the United States, at least as early as [redacted]. For example, Shinhan sold 99086 in the United States at least as early as [redacted]

[redacted]. SHINHAN00000759. Accordingly, 99086 is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

g. PNC07B

Shinhan designed, developed, manufactured, used, and/or sold PNC07B around the world, including in the United States, before the respective priority dates of the Asserted Patents. For example, as of May 2, 2008, Shinhan had already designed, developed, manufactured, used, and sold PNC07B (e.g., having lot numbers [redacted]) to [redacted]. SAMSUNG_CMS_007237. PNC07B was used in the United States, and around the world. Accordingly, PNC07B is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

h. ARIX-R

Shinhan designed, developed, manufactured, used, and/or sold ARIX-R around the world, including in the United States, before the respective priority dates of the Asserted Patents. For example, as of 2013, Shinhan had already designed, developed, manufactured, used, and offered to sell ARIX-R to [redacted]. SAMSUNG_CMS_006358. Accordingly, ARIX-R is prior art under at least pre-AIA §§ 102(a) and (b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

* * *

For the reasons provided below, Shinhan PA invalidates every Asserted Claims of the Asserted Patents. SHINHAN00000001–SHINHAN00001057; SAMSUNG_CMS_007427.

3. EHWA CMP Pad Conditioner ("EHWA PA")

Ehwa Diamond Industrial Co. Ltd. ("EHWA") is a CMP pad conditioner manufacturer headquartered in South Korea. EHWA's CMP pad conditioners have been imported into or sold

[redacted]

in the United States and around the world. As used herein, "EHWA CMP Pad Conditioner" ("EHWA PA" in short) refers to CMP pad conditioners developed, manufactured, fabricated, or supplied in the United States, and around the world, by EHWA before the respective priority dates of the Asserted Patents.

For example, EHWA PA that was known or used by others in the United States, in public use, on sale, offered for sale in the United States, and/or made by another in the United States who had not abandoned, suppressed, or concealed it before the priority date of the '862 Patent is prior art to the '862 Patent under pre-AIA §§ 102(a), (b), and/or (g)(2); EHWA PA that was in public use, on sale, offered for sale, and/or otherwise available to the public before the priority date of the '802 Patent is prior art to the '802 Patent under AIA § 102[8].

Examples of EHWA PA include at least the following CMP pad dressers.

a. BSL-CMP

BSL-CMP is a CMP pad conditioner that attaches diamond particles onto the rigid substrate using a brazing technology. SAMSUNG_CMS_007260 ("EHWA Analysis"). As early as [redacted], BSL-CMP was designed, developed, manufactured, used, and/or sold around the world, including in the United States. For example, EHWA sold BSL-CMP to [redacted]. EHWA00000048–EHWA00000057; EHWA sold BSL-CMP to [redacted]. EHWA00000008–EHWA00000036; and EHWA sold BSL-CMP to [redacted]. EHWA00000042–EHWA00000047.

EHWA also sold or offered to sell a physical article of BSL-CMP, identified by the product number [redacted], to [redacted]

[8] To the extent the '802 Patent is determined to be entitled to a priority date earlier than March 16, 2013, the pre-AIA version of § 102 governs, including pre-AIA §§ 102(a), (b), and/or (g)(2). Even under the pre-AIA provisions of the patent laws, Defendants' invalidity contentions would apply based on prior art identified herein.

[redacted]

[redacted]—on [redacted]. EHWA00000072. Similarly, EHWA also sold or offered to sell a physical article of BSL-CMP, identified by the product number [redacted], to [redacted] on [redacted]. EHWA00000095. General Tool, Inc. also sold or offered to sell a physical article of the product number [redacted], on [redacted]. GeneralTool_000314; *see also* EHWA00000132.

In addition, General Tool, Inc. provided BSL-CMP, identified by the product number 00315036, to a third party at least as early as May 2010.



EHWA Analysis at 2.

Accordingly, BSL-CMP is prior art under at least pre-AIA §§ 102(a) and 102(b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent. EHWA Analysis.

b. CVD-CMP

CVD-CMP is a CMP pad conditioner that forms a layer of diamond on a conditioner substrate using a CVD technology. As early as [redacted], CVD-CMP was designed, developed,

[redacted]

manufactured, used, and/or sold around the world, including in the United States. EHWA00000003; EHWA00000005– EHWA00000007; EHWA00000058–EHWA00000061. For example, EHWA sent CVD-CMP to [redacted] in [redacted]. EHWA00000003; to [redacted]. EHWA00000007; EHWA00000005; and to [redacted] in [redacted]. EHWA00000006. EHWA also sent CVD-CMP to [redacted] in [redacted]. EHWA00000058; EHWA00000059.

* * *

For the reasons provided below, EHWA PA invalidates every Asserted Claims of the Asserted Patents. EHWA00000001–EHWA00000254; EHWA Analysis.

4. 3M Diamond CMP Pad Conditioner ("3M PA")

3M Company ("3M") is a CMP pad conditioner manufacturer headquartered in the United States. 3M's CMP pad conditioners were sold in the United States and around the world since at least 2000. *See* SAMSUNG_CMS_006503. As used herein, "3M Diamond CMP Pad Conditioner" ("3M PA" in short) refers to a "3M Diamond Pad Conditioner"[9] developed, manufactured, fabricated, or supplied in the United States, and around the world, by 3M before the respective priority dates of the Asserted Patents. *See* SAMSUNG_CMS_006489.

For example, 3M PA that was known or used by others in the United States, in public use, on sale, offered for sale in the United States, and/or made by another in the United States who had not abandoned, suppressed, or concealed it before the priority date of the '862 Patent is prior art to the '862 Patent under pre-AIA §§ 102(a), (b), and/or (g)(2); 3M PA that was in public use, on

[9] Sung accuses Texas Instrument ("TI") of infringing at least the Asserted Patents in *Sung v. Texas Instruments Inc.*, Case No. 4:23-cv-00723 (E.D. Tex. Aug. 21, 2024) ("TI Action"), in part for TI's use of 3M Diamond Pad Conditioners, including A160. *See* TI Action, D.I. 28 ("TI's Motion for Summary Judgment of Invalidity," or "TI MSJ" in short).

[redacted]

sale, offered for sale, and/or otherwise available to the public before the priority date of the '802 Patent is prior art to the '802 Patent under AIA § 102[10].

3M PA "utilize sintered abrasive technology for excellent diamond retention for longer life, with controlled diamond placement and protrusion. Their single-layered diamond grid with highly controlled spacing enables you to better predict and optimize your CMP pad usage, for better planarization efficiency." SAMSUNG_CMS_006489.

Examples of 3M PA include at least the following CMP pad dressers.

a. 3M-A160

3M-A160 is a Diamond CMP pad conditioner with abrasive materials formed using "nickel based alloy with patterned diamond." SAMSUNG_CMS_006497. 3M designed, developed, manufactured, used, and/or sold 3M-A160 since at least 2000. For example, as early as 2000, 3M sold 3M-A160 to customers around the world, including those in the United States, such as TI. *See Sung v. Tex. Instruments Inc.*, Case No. 4:23-cv-00723 (E.D. Tex.) ("TI Action"), D.I. 28 ("TI's Motion for Summary Judgment of Invalidity," or "TI MSJ" in short).

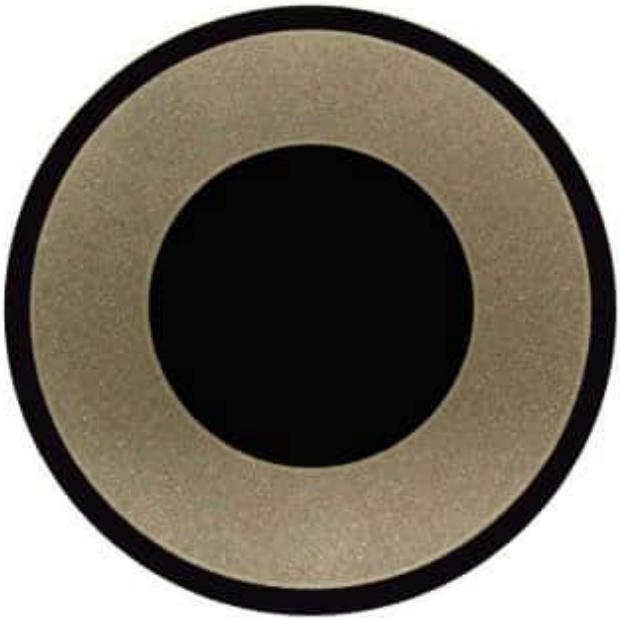
Accordingly, 3M-A160 is prior art under at least pre-AIA §§ 102(a) and 102(b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

b. 3M-A2810

3M designed, developed, manufactured, used, and/or sold a 3M Diamond CMP pad dresser identified by the part number 3M-A2810 since at least 2010. For example, a group of researchers in Arizona and Japan published a paper in 2011 on the use of 3M-A2810, shown below, before October 18, 2010. *See* SAMSUNG_CMS_006499 (showing a manuscript submittal date of October 18, 2010).

[10] To the extent the '802 Patent is determined to be entitled to a priority date earlier than March 16, 2013, the pre-AIA version of § 102 governs, including pre-AIA §§ 102(a), (b), and/or (g)(2).

[redacted]



Accordingly, 3M-A2810 is prior art under at least pre-AIA §§ 102(a) and 102(b) against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

c. 3M-A3700

3M designed, developed, manufactured, used, and/or sold a 3M Diamond CMP pad dresser identified by the part number 3M-A3700 since at least 2012. For example, a group of researchers in Arizona and Japan published a paper in 2013 on the use of 3M-A3700, shown below, before August 15, 2012. *See* SAMSUNG_CMS_006510 (showing a submittal date of August 15, 2012).

[redacted]



Accordingly, 3M-A3710 is prior art under at least pre-AIA §§ 102(a) and 102(b) against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

d. 3M-A82

3M designed, developed, manufactured, used, and/or sold a 3M Diamond CMP pad dresser identified by the part number 3M-A82 in the United States as early as 2007. Accordingly, 3M-A82 is prior art under at least pre-AIA §§ 102(a) and 102(b) against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

* * *

For the reasons provided below, 3M PA invalidates every Asserted Claims of the Asserted Patents. *See supra* TI MSJ; SAMSUNG_CMS_006497; SAMSUNG_CMS_006499; SAMSUNG_CMS_006510.

[redacted]

5. Abrasive Technology Inc. CMP Pad Conditioners ("ATI PA")

Abrasive Technology, Inc. ("ATI") is a CMP pad conditioner manufacturer headquartered in the United States. ATI's CMP pad conditioners sold in the United States and around the world since at least [redacted]. AT000001; AT000067; AT000071; AT000073; AT000077; AT000078; AT000079; AT000080; AT000163–AT000244. As used herein, "Abrasive Technology CMP Pad Conditioners" or "ATI CMP Pad Conditioners" ("ATI PA" in short) refers to a CMP pad conditioner developed, manufactured, fabricated, or supplied in the United States, and around the world, by ATI before the respective priority dates of the Asserted Patents.

For example, ATI PA that was known or used by others in the United States, in public use, on sale, offered for sale in the United States, and/or made by another in the United States who had not abandoned, suppressed, or concealed it before the priority date of the '862 Patent is prior art to the '862 Patent under pre-AIA §§ 102(a), (b), and/or (g)(2); ATI PA that was in public use, on sale, offered for sale, and/or otherwise available to the public before the priority date of the '802 Patent is prior art to the '802 Patent under AIA § 102[11].

Examples of ATI PA include at least the following CMP pad dressers.

a. ATI-Infinity II

ATI introduced ATI-Infinity II in 2000 as its third-generation product. AT000093 at 11; AT000001 at 34. ATI designed, developed, manufactured, used, and/or sold ATI-Infinity II as early as [redacted]. For example, ATI sold ATI-Infinity II to at least [redacted] as early as [redacted]. *See, e.g.,* AT000001 at 41–42; AT00007; AT000073; AT000077; AT000080; AT000163–AT000181; AT000186–AT000191.

[11] To the extent the '802 Patent is determined to be entitled to a priority date earlier than March 16, 2013, the pre-AIA version of § 102 governs, including pre-AIA §§ 102(a), (b), and/or (g)(2).

[redacted]



Accordingly, ATI-Infinity II is prior art under at least pre-AIA §§ 102(a) and 102(b) against the ’862 Patent and/or the ’802 Patent, and/or under at least AIA §§ 102(a)(1) against the ’802 Patent.

b. ATI-Infinity Ver. 6.1

ATI introduced Infinity Version 6.1 around 2004 as its sixth-generation product. AT000093 at 14; AT000341. ATI designed, developed, manufactured, used, and/or sold Infinity Version 6.1 as early as [redacted]. For example, ATI sold ATI-Infinity Ver. 6.1 to at least [redacted] as early as [redacted]. AT000071; AT000073; AT000077; AT000080; AT000182–AT000188; AT000190–AT2000244. ATI also published articles demonstrating ATI-Infinity Ver 6.1’s capabilities as early as 2005. AT000131–AT000136.

[redacted]



Accordingly, ATI- Infinity Ver. 6.1 is prior art under at least pre-AIA §§ 102(a) and 102(b) against the '862 Patent and/or the '802 Patent, and/or under at least AIA §§ 102(a)(1) against the '802 Patent.

* * *

For the reasons provided below, ATI PA invalidates every Asserted Claims of the Asserted Patents. AT000001–AT000341. *See also* D.I. 1, Exs. 7, 12 (infringement chart against ATI's Infinity II).

D. Claim Charts

Individual claim charts that identify at least one example of where each element of each Asserted Claim can be found in each item of prior art are attached hereto. As previously stated, the disclosures, combinations, and citations in the claim charts are not exhaustive of all anticipation and obviousness arguments and combinations Defendants may assert. A listing of these claim charts is provided below:

'862 Patent

Exhibit Number	Prior Art
862-1	Saesol PA
862-2	Shinhan PA
862-3	EHWA PA
862-4	3M PA

[redacted]

Exhibit Number	Prior Art
862-5	ATI PA
862-6	Smith
862-7	Ishizuka
862-8	Kinik298
862-9	Liao
862-10	Sung479
862-11	Kinik2008
862-12	Collection of Additional Prior Art References

’802 Patent

Exhibit Number	Prior Art
802-1	Saesol PA
802-2	Shinhan PA
802-3	EHWA PA
802-4	3M PA
802-5	ATI PA
802-6	Yen
802-7	Smith
802-8	Lawing
802-9	Liao
802-10	Tian
802-11	Ishizuka
802-12	Kinik2008
802-13	Collection of Additional Prior Art References

E. State of the Art

1. Conditioning Polyurethane CMP Pads By Rotating Or Pressing A Dresser Against A Rotating CMP Pad Was Well-Known.

Under at least the apparent construction based on Plaintiff’s Infringement Contentions for the ’862 Patent, a method for conditioning CMP pads by rotating or pressing a CMP pad dresser against a rotating CMP pad was well-known in the art long before the respective priority dates of the ’862 Patent.

For example, under at least the apparent construction based on Plaintiff’s Infringement Contentions, limitation 1(a) of Exhibits 862-1 through 862-12, claim 11 of Exhibits 862-6 through 862-12, and claim 20 of Exhibits 862-6 through 862-7 and 862-9 through 862-12 provide

[redacted]

numerous examples of references (collectively, the "Conditioning Pad References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Sung479, Kinik2008, Van Buskirk, Shinoda, CMPUG 2009, Beratan, Kinik869,—that teach conditioning CMP pads (e.g., made of polyurethane) by, for example, pressing a CMP pad dresser on a CMP pad and rotating the CMP pad, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in limitation 1(a) of Exhibits 862-1 through 862-12, claim 11 of Exhibits 862-6 through 862-12, and claim 20 of Exhibits 862-6 through 862-7 and 862-9 through 862-12 in demonstrating that this concept was well-known.

- See, e.g., AT000280 at 54



- Smith at 2:8-12 ("One type of CMP pad conditioner is a four-inch disc with fixed diamond abrasives. ***The diamond coated disc is rotated and pressed onto the polishing pad surface to cut and remove the top layer***. The diamonds are typically set in an epoxy or a metal matrix material. However diamonds from these pad

[redacted]

conditioners can become dislodged which can lead to yield loss due to scratching of the wafer during the polishing operation.").

- Smith at 1:27-2:7 ("***A typical polishing pad comprises closed-cell polyurethane foam approximately 0.16 centimeters thick***. During pad conditioning, the pads are subjected to mechanical abrasion in order to physically cut through the cellular layers of the pad surface. The exposed surface of the pad contains open cells, which can be used during the CMP process to trap abrasive slurry consisting of the spent polishing slurry and material removed from the wafer. In each subsequent pad-conditioning step, the pad conditioner removes the outer layer of cells containing the embedded materials and minimizes removal of layers below the outer layer. Over-texturing of the polishing pad results in a shortened life, while under-texturing results in insufficient material removal rate and lack of wafer uniformity during the CMP step.").
- Ishizuka, Fig. 2:

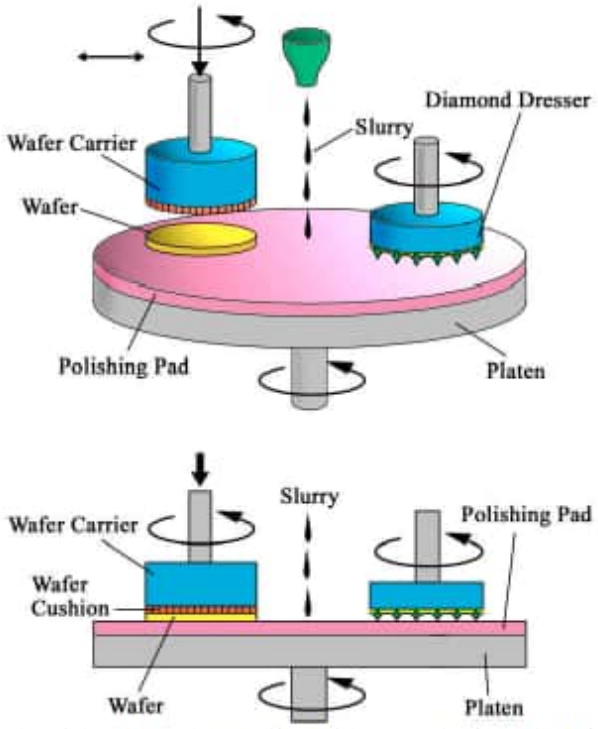


Fig. 2: The CMP layout includes a rotating pad, a feeding slurry, and a rotating pad conditioner.

- Ishizuka at 10:19-27 ("The ***CMP pad is made of porous polyurethane***. The pores are used to store slurry for polishing. With the trend of polishing ever delicate circuitry on IC wafers, the pores are getting smaller (e.g. 20 microns) and their volume fraction is reduced (e.g. 20 V%). Since the polishing is performed on the two dimensional surface, the longevity of the pad life is determined by the dressing rate. ADD can minimize the excessive cutting of the pad, hence, it is actually a pad saver (Fig. 15).").
- Kinik298 at [0077] ("In one embodiment of the invention, the spacing of the pyramids can be adjusted to adjust the ***contact pressure*** of each cutting point, edge or mesa. In general, the farther the pyramids are spaced from one another, the higher the ***contact pressure between the pyramid and the pad.*** Thus, the fewer tips present to support the applied force, the deeper the penetration of each of the tips and the

larger the formed asperities. Generally, the polishing rate of the wafer is dependent on the number and size of the asperities. Denser, smaller asperities can polish as fast as fewer, larger asperites. But the former is more uniform with no excessive force that may cause non-uniformity, scratching, erosion or dishing of the delicate wafer, etc. This can be particularly true with copper smaller than 90 nm and with low-k dielectric having greater than 20% pores.").

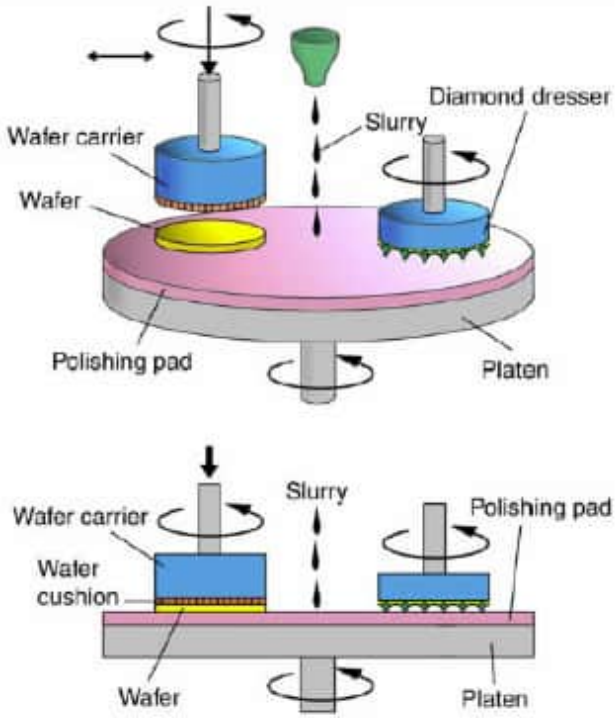
- Liao at Abstract ("A ***conditioner or dresser is needed to regenerate the asperity structure of the pad*** to recover its designed ability in the chemical mechanical polishing (CMP) process. The effects of the design parameters of a pad conditioner, such as diamond spacing, diamond leveling, which is defined as the height distribution of the diamond, and substrate flatness on the pad dressing rate (D.R.) were studied by experiments. It is found that the dresser with large diamond spacing, such as 700μm, results in high D.R. A better diamond leveling, i.e. closer to normal distribution, tends to have a stable D.R. The diamond dresser with center protruded substrate leads to a stable and higher D.R. A pad dressing rate model relating power consumption and characteristics of the diamond dresser was derived. The parameters in the model were obtained by regression analysis. By using this model, the pad dressing rate can be successfully predicted. The model can be used to aid the efficiency and stability assessment for the CMP process.").
- Liao at 374 ("In metal cutting, if F_P and A denote the tangential cutting force and undeformed chip area, then the specific cutting energy defining as the energy required to remove a unit volume of metal u is given by F_P /A. Similarly, the specific dressing energy *u*d can be defined by the same expresion. But ***F_P is the***

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friction force and it is equal to μF, where ***μ is the friction coefficient and F is the downforce***. If N is the total number of working diamonds, and w is the average groove width scribed by the diamonds, then the total area of contact between the diamonds and the pad, A, is $A \sim N^{n1} w^{n2}$.

- Sung479 [0006] ("Performance of a CMP process is mainly affected by a pad conditioner, which is used to condition a polishing pad, i.e., ***to form a stable structure of pad asperities*** on the polishing pad.").
- Kinik2008 Figure 2:

Figure 2 The CMP layout that includes a rotating pad, a feeding slurry and a rotating pad conditioner (see online version for colours)



- Kinik2008 at 329 ("The CMP is accomplished by polishing the wafer with a ***polymer pad (e.g. polyurethane***). The pad is mounted on a rotating platen with controlled speed. A slurry is introduced to the pad that will spread across the pad surface by spinning of the pad and by pushing around with both wafer and pad

conditioner. The slurry contains nanometer (e.g. 100 nm) sized abrasive particles (e.g. ceria) that are dispersed in a chemical solution (e.g. hydrogen peroxide). During the polishing action, chemical reactants (e.g. copper oxide) from the surface of the circuitry will be abraded away by free moving abrasive particles suspended in the slurry (Figure 2).").

- AT2006 at AT000138 ("A novel ceramic-based CMP conditioning disk (Patent Pending) is described and its performance in a commercial CMP system is evaluated. While the physical properties, size, size distribution and concentration of diamond grains are the main factors in determining disk performance, the uniformity of the diamond plane greatly influences the percentage of individual abrasive particles effectively conditioning the polishing surface. Presented here is a CMP conditioning disk having an ultra-flat diamond plane, achieved by using an ultra-flat ceramic substrate. By reducing the height variation in the diamond layer, the aggressiveness and life of the disk can be readily tuned by varying the diamond properties. An additional benefit is that the ceramic CMP conditioner is inert to ceria based slurries and aggressive low pH metal slurries. Experimental data is presented on oxide removal rates and non-uniformity of thermal oxide wafers polished using an Applied Materials Mirra Mesa® polishing tool. Although pad cut rates were negligible, oxide removal rates were comparable with the reference Best Known Method (BKM) over the lifetime of the disk. Microscopy of the disks after use confirms that a high percentage of the diamond grains exhibit wear from contact with the polishing pad, confirming the effectiveness of this type of disk and the

[redacted]

overall flatness of the diamond plane. A white light chromatic aberration technique was used to confirm the overall flatness of the conditioning plane.").

- Lawing at [0042] ("The present invention provides the ability to precisely control relative abrasive particle height which enables the manufacture of "self-limiting" pad conditioners. ***Self-limiting pad conditioners limit the penetration depth of the abrasive particles into the polishing pad materials*** by limiting the protrusion of the abrasive particles from the matrix. FIGS. 4A and 4B contrast the differences between conventional (FIG. 4A) and self-limiting (FIG. 4B) pad conditioning. In conventional conditioning, abrasive particles (42) are fixed to a substrate (41) with a relatively small amount of material (43). On fixed abrasive polishing pads, fixed abrasive posts (44) are situated on a pad substrate (45). Typically, the diamond particles have a larger dimension (on the order of 150 μm) than the fixed abrasive post (typically 40 μm high by 200 μm wide). As such, the abrasive particles (42) can destroy the fixed abrasive post (44) as the two protrusions are brought into contact under typical conditioning pressures and relative velocities.").
- Kinik869 at [0004] ("One problem that arises with regard to maintaining the pad surface, however, is an accumulation of polishing debris coming from the work piece, the abrasive slurry, and the pad dresser. This accumulation causes a "glazing" or hardening of the top of the pad, mats the fibers down, and thus makes the pad surface less able to hold the abrasive particles of the slurry. These effects significantly decrease the pad's overall polishing performance. Further, with many pads, the pores used to hold the slurry, become clogged, and the overall asperity of the pad's polishing surface becomes depressed and matted. ***A CMP pad dresser can***

[redacted]

be used to revive the pad surface by "combing" or "cutting" it. This process is known as "dressing" or "conditioning" the CMP pad. Many types of devices and processes have been used for this purpose. One such device is a disk with a plurality of superhard crystalline particles such as diamond particles attached to a metal-matrix surface.").

- Van Buskirk at 2:55-60 ("***The polishing pad, generally a polyurethane-based material***, performs two primary functions. The polymeric foam cell walls of the pad aid in removal of the reaction products at the wafer surface and the pores within the pad assist in supplying the slurry to the pad/wafer interface.").

2. Applying A Slurry To Polish A Wafer Having Semiconductor Devices With Certain Metallic or Oxide Layer and Certain Line Widths Was Well-Known.

Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 Patent, applying a slurry to the rotating CMP pad and polishing a workpiece—such as a semiconductor device—by applying the workpiece to the CMP pad was well-known in the art. It was also well known that the semiconductor device included features of certain linewidths, such as 30 nm or less, and that the semiconductor device included various metallic and non-metallic materials, such as copper, tungsten, oxide, or combinations of those materials. Moreover, it was well known that the slurry could be made using various materials, such as abrasive materials made out of silica, alumina, ceria, and the like, and an oxidative compound, such as hydrogen peroxide.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, claim 11 of Exhibits 862-6 through 862-12, claim 12 of Exhibits 862-6 through 862-8 and 862-10 through 862-12, claim 13 of Exhibits 862-6 through 862-8 and 862-11 through 862-12, claim 15 of Exhibits 862-7 through 862-8 and 862-11 through 862-12, and claims 17–19 of

[redacted]

Exhibits 862-7 and 862-11 through 862-12 provide numerous examples of references (collectively, the "Polishing Workpiece References ")—including Smith, Ishizuka, Kinik298, Liao, Sung479, Kinik2008, and Van Buskirk, Shinoda, Neville, Lawing, Beratan, Miyagawa, Natori, Izumi, Gambino, Tanaka, Kinik869—that teach applying a slurry to polish a workpiece such as a semiconductor device with linewidths below 30 nm and the slurry including various materials (e.g., abrasive materials made out of silica, alumina, ceria, and the like, and an oxidative compound, such as hydrogen peroxide), and that the semiconductor device may contain materials, such as copper, tungsten, oxide, or combinations of those materials, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in claim 11 of Exhibits 862-6 through 862-12, claim 12 of Exhibits 862-6 through 862-8 and 862-10 through 862-12, claim 13 of Exhibits 862-6 through 862-8 and 862-11 through 862-12, claim 15 of Exhibits 862-7 through 862-8 and 862-11 through 862-12, and claims 17–19 of Exhibits 862-7 and 862-11 through 862-12 in demonstrating that this concept was well-known.

- See, e.g., AT000280 at 54



[redacted]

- See, e.g., AT000137 at 3

EXPERIMENTAL DETAILS

Flatness measurements were obtained using the technique of white light chromatic aberration with a Micromeasure Plus 3D profilometer. Measurements were made using a probe having a Z resolution of 30 nm and a lateral resolution of 3 µm. The full range scan was 94 mm x 94 mm (full face of disk) with a step scan of 15 µm x 250 µm.

Polishing experiments were performed on an Applied Materials Mirra Mesa® CMP Platform at Entrepix, Inc., Phoenix, Arizona. A representative oxide BKM was followed, using a Rohm & Haas IC1010 polishing pad and Klebosol® 1501-50 slurry. A secondary stage with 2% NH_4OH solution on a Politex® pad was used as a buffing step, prior to cleaning in the Mesa module.

Post conditioning worn crystal analysis was conducted using an optical stereomicroscope at 30x magnification.

Immersion testing with agitation was performed in a ceria based slurry (Silect 6000), a ferric nitrate mixture (pH 1.0), and an acid copper slurry. Immersion duration was up to 96 hours.

- See, e.g., ATI000137 at 5

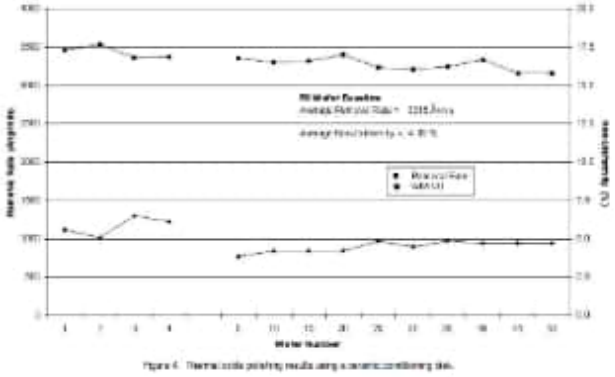


Figure 4 shows oxide removal rates and non-uniformity on thermal oxide wafers polished using an Applied Materials Mirra CMP tool. Although pad cut-rates were low, oxide removal rates were comparable with the reference BKM over the lifetime of the disk. Microscopy of the disks after use confirms that a high percentage of the diamond grains exhibit wear, confirming the effectiveness of this type of disk and the overall flatness of the conditioning plate.

- Smith at 10:2-15 ("Referring now to FIG. 1, a wafer polishing apparatus 30 with a pad conditioner 32 in a chemical mechanical planarization (CMP) process is depicted in an embodiment of the invention. The depicted wafer polishing apparatus 30 includes a ***rotation table 34 having an upper face 36 with a CMP pad 38 (such as a polymeric pad) mounted thereon***. A wafer head 42 having a wafer substrate 44 mounted thereon is arranged so that the wafer substrate 44 is in contact with the CMP pad 38. In one embodiment, ***a slurry feed device 46 provides an abrasive slurry 48 to the CMP pad*** 38. In operation, the ***rotation table 34 is rotated so that the CMP pad 38 is rotated beneath the wafer head 42, pad conditioner 32 and slurry feed device 46***. The wafer head 42 contacts the CMP pad 38 with a

[redacted]

downward force F. The wafer head 42 can also be rotated and/or oscillated in a linear back-and-forth action to augment the polishing of the wafer substrate 44 mounted thereon. The pad conditioner 32 is also in contact with the CMP pad 38, and is translated back and forth across the surface of the CMP pad 38. The pad conditioner 32 can also be rotated.").

- Smith at 1:9-11 ("The disclosure is directed generally to ***semiconductor manufacturing equipment.*** More specifically, the disclosure is directed to conditioning devices for the cleaning of polishing pads used in the ***manufacture of semiconductors***.").
- Ishizuka at 1:17-2:11 ("The CMP is accomplished by polishing the wafer with a polymer pad (e.g. polyurethane). The ***pad is mounted on a rotating platen with controlled speed***. ***A slurry is introduced to the pad that will spread across the pad surface by spinning of the pad*** and by pushing around with both wafer and pad conditioner. ***The slurry contains nanometer (e.g. 100 nm) sized abrasive particles (e.g. ceria) that are dispersed in a chemical solution (e.g. hydrogen peroxide***). During the polishing action, chemical reactants (e.g. copper oxide) from the surface of the circuitry will be abraded away by free moving abrasive particles suspended in the slurry. During the CMP process, the polished debris must be removed periodically, otherwise, the pad top will be loaded with dirt known as glazing. In order to get rid of the accumulation of the removed materials, a diamond pad conditioner is used to push the waste around and eventually discharge the debris along the pad periphery. In addition to the elimination of contaminants deposited on the pad top, pressure must be increased locally on the pad asperities to cause the

abrasion at the contact points between wafer and pad. In order to create the pressurized points, the contact area must be reduced. Hence, the same diamond pad conditioner must groove the pad top to create asperities. The size and distribution of these asperities actually determine the efficiency of the polishing and the quality of the polished wafer (Fig.2).

- Ishizuka at Figure 7 caption ("Fig. 7: The cutting tips of ADD can be tailor made in shape and in distribution. ***This flexibility makes ADD the unique pad conditioners for ECMP manufacture of future Moore's Law semiconductors with node sizes of 45 nm, 32 nm, and 22 nm***.").
- Ishizuka, Fig. 3

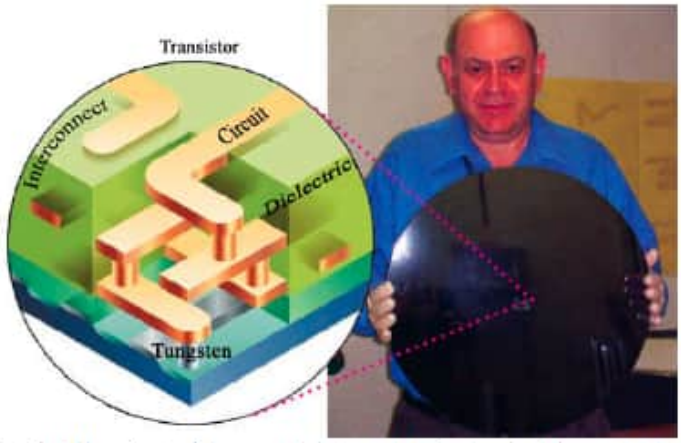


Fig. 3: The size of future 450 mm (16 inches) silicon wafer is 10 million times (10^7x) larger than the node size (45 nm) of the transistors. In order to polish the soft copper layer burried in the delicate low-k dielectric matrix, the contact pressure between the IC and the tips of pad asperities for ECMP must be one order of magnitude lower than that for conventional CMP. Consequently, only pad conditioners that can generate very uniform pad asperities may be used.

- Kinik298 at [0052] ("The cutting devices of the present invention can be utilized in a number of applications, and in one embodiment are particularly well adapted for use in planing substantially brittle materials, such as silicon wafers, glass sheets,

[redacted]

metals, used silicon wafers to be reclaimed by planarization, LCD glass, LED substrates, SiC wafers, quartz wafers, silicon nitride, zirconia, etc***. In conventional silicon wafer processing techniques, a wafer to be polished is generally held by a carrier positioned on a polishing pad attached above a rotating platen. As slurry is applied to the pad*** and pressure is applied to the carrier, the wafer is polished by relative movements of the platen and the carrier. Thus, the silicon wafer is essentially ground or polished, by very fine abrasives, to a relatively smooth surface.").

- Kinik298 at [0003] ("It is estimated that the ***semiconductor*** industry currently spends more than one billion U.S. Dollars each year manufacturing silicon wafers that exhibit very flat and smooth surfaces. Typically, chemical mechanical polishing ("CMP") is used in the manufacturing process of ***semiconductor devices*** to obtain smooth and even-surfaced wafers. In a conventional process, a wafer to be polished is generally held by a carrier positioned on a polishing pad attached above a rotating platen. As slurry is applied to the pad and pressure is applied to the carrier, the wafer is polished by relative movement of the platen and the carrier.").
- Kinik298 at [0005] ("In addition to these considerations, the ***line width (e.g., nodes) of the circuitry on semiconductors is now approaching the virus domain (e.g., 10-100 nm)***. In addition, more layers of circuitry are now being laid down to meet the increasing demands of advanced logic designs. In order to deposit layers for making nanometer sized features, each layer must be extremely flat and smooth during the semiconductor fabrication. While diamond grid pad conditioners have been

effectively used in dressing CMP pads for polishing previous designs of integrated circuitry, they have not been found suitable for making cutting-edge devices with nodes smaller than 65 nm. This is because, with the decreasing size of the ***copper wires***, non-uniform thickness due to rough- or over-polishing will change the electrical conductivity dramatically. Moreover, due to the use of coral-like dielectric layers, the fragile structure must be polished very gently to avoid disintegration. Hence, the pressure used in CMP processes must be reduced significantly.").

- Liao at 371 ("Chemical mechanical polishing (CMP), a surface planarization process, is essential as the line width continues to shrink and circuit geometries get tighter in VLSI technology. In the CMP process, chemical reaction takes place between the wafer and chemicals. The reaction product would gradually accumulate onto the holes and grooves of the pad surface leading to the so-called glazing of the pad [1]. The wafer removal rate is degraded as a result because the ***slurry*** can no longer distribute uniformly on the pad surface. Dressing of the pad by a diamond conditioner so as to regenerate a new pad surface and recover its role in the polishing process is thus necessary.").
- Sung479 [0002] ("Many industries utilize a chemical mechanical polishing (CMP) process for polishing certain work pieces. Particularly, the computer manufacturing industry relies heavily on CMP processes for polishing wafers of ceramics, silicon, glass, quartz, and metals. Such polishing processes generally entail applying the wafer against a rotating pad made from a durable organic substance such as polyurethane. ***A chemical slurry is utilized that contains a chemical capable of***

breaking down the wafer substance and an amount of abrasive particles which act to physically erode the wafer surface. The slurry is continually added to the rotating CMP pad, and the dual chemical and mechanical forces exerted on the wafer cause it to be polished in a desired manner.").

- Sung479 [0005] ("Ultra-large-scale integration (ULSI) is a technology that places at least 1 million circuit elements on a single ***semiconductor*** chip. In addition to the tremendous density issues that already exist, with the current movement toward size reduction, ULSI has become even more delicate, both in size and materials than ever before. Therefore, the CMP industry has been required to respond by providing polishing materials and techniques that accommodate these advances. For example, lower CMP polishing pressures, smaller size abrasive particles in the slurry, and polishing pads of a size and nature that do not over polish the wafer must be used. Furthermore, pad dressers that cut asperities in the pad which can accommodate the smaller abrasive particles, and that do not overdress the pad must be used.").
- Kinik2008 at 329 ("The CMP is accomplished by polishing the wafer with a polymer pad (e.g. polyurethane). ***The pad is mounted on a rotating platen*** with controlled speed***. A slurry is introduced to the pad that will spread across the pad surface by spinning of the pad and by pushing around with both wafer and pad conditioner***. ***The slurry contains nanometer (e.g. 100 nm) sized abrasive particles (e.g. ceria) that are dispersed in a chemical solution (e.g. hydrogen peroxide).*** During the polishing action, chemical reactants (e.g. copper oxide) from the surface

[redacted]

of the circuitry will be abraded away by free moving abrasive particles suspended in the slurry (Figure 2).").

- Kinik2008, at 328 (" The semiconductor chips (e.g. ULSI) has been progressing by following the so-called Moore's Law. As a result, the number of transistor numbers on a CPU has been doubling about every 18 months since the Law was predicted in 1965. Due to the relent miniaturisation of transistors, the circuitry for the chip must be down sized continually. ***The line, wide of the circuitry (node) is now encroaching upon the virus domain (10–100 nm)***. In addition, more layers of circuitry must be laid down to meet the increasing demand of logic designs. In order to deposit layers for making nanometer-sized features, each layer must be extremely flat and smooth during the semiconductor fabrication. Consequently, Chemical Mechanical Planarisation (CMP) has been employed by the industry to manufacture semiconductor devices (Figure 1).").
- Kinik2008, at 338 ("This flexibility makes ADD the unique pad conditioners for ECMP manufacture of future Moore's Law semiconductors with ***node sizes of 45 nm, 32 nm and 22 nm***.").
- Van Buskirk at 4:1-11 ("***The purpose of the slurry is simple, yet understanding and modeling all the mechanical and chemical reactions involved is extremely difficult. Essentially, the surface of the material being polished is chemically altered to a softer composition, which is then mechanically removed by the pad and slurry abrasives. Thus, the slurry provides both chemical and mechanical forces in the CMP process. Oxide slurries are relatively new and largely experimental, yet the most common are ferric nitrate with an alumina abrasive***

[redacted]

and low pH. Some polysilicon and polyimide slurries exist, but are still in the prototype and developmental stages.").

- Kinik869 [0002] (" Many industries utilize a chemical mechanical polishing (CMP) process for polishing certain work pieces. Particularly, the computer manufacturing industry relies heavily on CMP processes for polishing wafers of ceramics, silicon, glass, quartz, and metals. Such polishing processes generally entail applying the wafer against a rotating pad made from a durable organic substance such as polyurethane. ***A chemical slurry is utilized that contains a chemical capable of breaking down the wafer substance and an amount of abrasive particles which act to physically erode the wafer surface. The slurry is continually added to the rotating CMP pad, and the dual chemical and mechanical forces exerted on the wafer cause it to be polished in a desired manner***.").
- Shinoda at [0011] ("On the other hand, a layer as a barrier conductor layer (often referred to as a barrier layer hereinafter) of, for example, tantalum compound such as tantalum, tantalum alloys or tantalum nitride is formed under the wiring metal such as copper or a copper alloy for preventing copper from diffusing into the interlayer insulation film and for improving adhesion. Accordingly, the exposed barrier layer should be removed by CMP at the portions other than the wiring portion for embedding copper or a copper alloy. However, since the conductor of the barrier layer is more rigid than copper or copper alloy, a sufficient polishing speed cannot be obtained by combining polishing materials for copper or copper alloy, and planarity is often impaired. Therefore, a two-stage polishing method

[redacted]

comprising a first step for polishing the wiring metal and a second step for polishing the barrier layer has been examined.").

- Neville at 2:9-23 ("Since CMP has been successfully used to polish oxide surfaces for a number of years, a recent trend in the semiconductor industry is to utilize CMP techniques and slurries for polishing metal layers. ***However, even though some slurries and polishing techniques have been directed to metal layers, films and plugs, such as tungsten, aluminum and copper, chemical mechanical polishing of these metals for device fabrication has not been well understood or developed***. As a result, the use of conventional silica or alumina slurries on metal layers has resulted in unacceptable polishing performance and yielded devices of poor quality. Accordingly, a need remains for improved chemical mechanical polishing techniques and slurries for the same which provide uniform metal layers, free from undesirable contaminants and surface imperfections.").
- Miyagawa at [0038] ("Thereafter, by means of the CVD method for example, as a fourth film, a polycrystalline silicon film 19 is formed on the boron silicate glass (BSG) film 18, thereby filling the recessed portion of the boron silicate glass (BSG) film 18, which corresponds to the space between the lines of the second pattern 17, with the polycrystalline silicon film 19, as shown in FIG. 7. ***Then, as shown in FIG. 8, by means of chemical mechanical polishing (CMP) method for example, the polycrystalline silicon film 19 and the BSG film 18 are polished until the top surface of the second pattern 17 is exposed, thereby removing an upper portion of the BSG film 18 as well as an upper portion of the polycrystalline silicon film***

[redacted]

19. As a result, it is possible obtain a structure where the space between the lines of the second pattern 17 is filled with the polycrystalline silicon film 19.").

- Natori at [0036] ("Various insulating films can be used as the interelectrode insulating film 28. However, for functionality as a ***semiconductor memory device***, the capacitance of the floating gate electrode (14, 16, 26, 40) and the control gate electrode (30, 32, 34, 41, 41 a) across the interelectrode insulating film 28 needs to be more than a certain value. ***In particular, a semiconductor memory device with its minimum line width downscaled to about 30 nm or less*** has a small opposing area of the floating gate electrode (14, 16, 26, 40) and the control gate electrode (30, 32, 34, 41, 41 a). In view of the coupling capacitance between the floating gate electrode (14, 16, 26, 40) and the control gate electrode (30, 32, 34, 41, 41 a), it is preferable to use a high dielectric constant insulating material with relative dielectric constant ∈r higher than that of SiO2 film. For example, the interelectrode insulating film 28 is preferably a high dielectric constant insulating film of hafnium aluminate (HfAlO), zirconium aluminate (ZrAlO), or lanthanum aluminate (LaAlO).").
- Gambino at 141-142 ("As the dimensions of Cu interconnects are reduced, the resistivity increases due to surface scattering, grain boundary scattering, and an increasing fraction of refractory metal liner in the trench (Fig. 2) [2,7]. In the past, it has been noted that for pure metals, the increase in resistivity with reduced thickness is less for Al than for Cu, because Al has a shorter electron mean free path compared to Cu (15 nm versus 39 nm) [8]. ***Hence, simulations show there is a cross-over point in resistivity of the pure metals, with Al having lower resistivity***

[redacted]

than Cu for line widths below 30 nm (Fig. 2). So should we go back to Al for on-chip interconnects? The answer is no, for two reasons. First, the resistivity of real Al wires goes up faster than that of pure Al, due to refractory metal layers that are required for reliability (Fig. 2) [2]. In addition, Cu has better reliability than Al in terms of electromigration***. Hence, Cu will continue to be used for interconnects down to the 22 nm node and beyond***.

- Tanaka at [0084] ("Next, as shown in FIG. 3G, the underlying film 130 is etched by using the hard mask pattern 136 a as an etching mask, thereby forming a slimming mask pattern 130 a. At this time, the underlying film 130 is side-etched using dry etching with oxygen plasma to form the slimming mask pattern 130 a having a line width smaller than that of the hard mask pattern 136 a. For example, when a minimum dimension of the hard mask pattern 136 a is set to 22 nm, a minimum line ***width of the sliming mask pattern 130 a can be set to 18 nm***.").
- Beratan at 1:49-64("The present invention relates to CMP polishing slurries which overcome many of the problems and disadvantages of the prior art polishing slurries. In accordance with the present invention, a slurry composition for use in chemical-mechanical polishing is provided. This composition is comprised of: a carrier solution comprising hydrogen peroxide and water; colloidal particles disposed in the carrier solution; and at least one salt dissolved in the carrier solution and comprising at least 0.1 weight percent (preferably at least 2 weight percent) of the slurry composition. The carrier solution may also comprise other liquids, such as ethylene glycol, propylene glycol, alcohols, and combinations of these. ***The colloidal particles preferably comprise colloidal silica or alumina particles with***

[redacted]

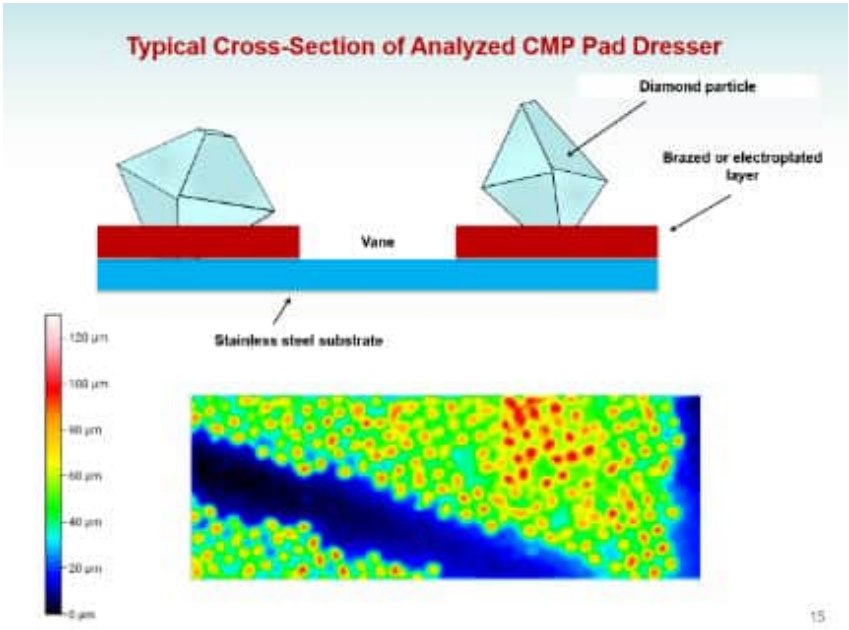
average size between 50 nm and 3 µm. The salt is preferably a halide salt (and more preferably sodium chloride).")

3. CMP Pad Dressers Having A Monolayer Of Superabrasive Particles Protruding from A Matrix Layer On A Rigid Support Substrate Were Well-Known.

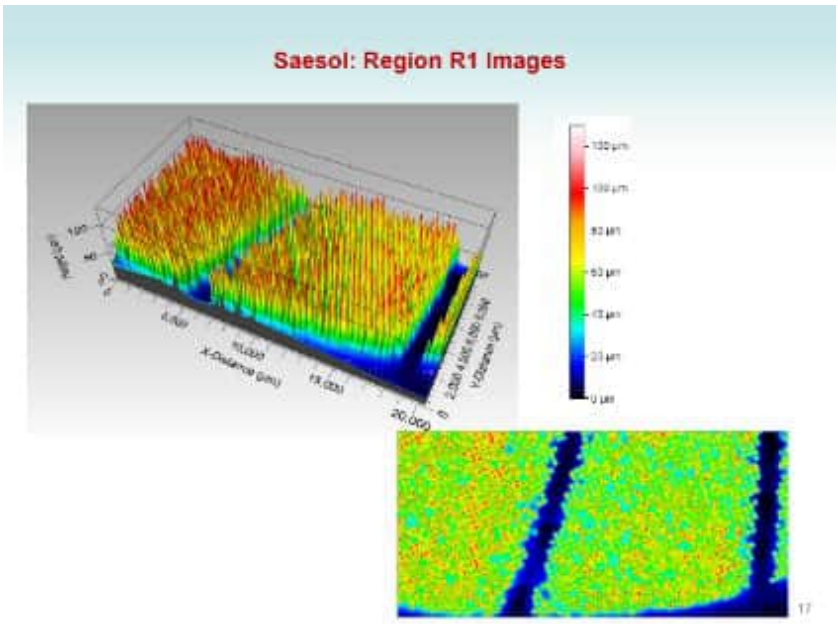
Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 and '802 Patents, CMP pad dressers with a monolayer of protruding superabrasive particles were well-known in the art long before the respective priority dates of the '862 and '802 Patents. Specifically, it was well known that superabrasive particles in a CMP pad dresser may protrude from a matrix layer—forming a monolayer on a rigid support substrate—and extend away from the rigid support substrate.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, limitation 1(b) of Exhibits 862-1 through 862-12; and limitations 1(a), 1(b), 1(c) of Exhibits 802-1 through 802-13 provide numerous examples of references (collectively, the "Monolayer References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Sung479, Kinik2008, Yen, Lawing, Tian, CMPUG2009, AT2006, Kinik869, and CMPUG2005—that teach CMP pad dressers with superabrasive particles protruding from a matrix layer—forming a monolayer on a rigid support substrate—and extending away from the rigid support substrate, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in limitation 1(b) of Exhibits 862-1 through 862-12; and limitations 1(a), 1(b), 1(c) of Exhibits 802-1 through 802-13 in demonstrating that this concept was well-known.

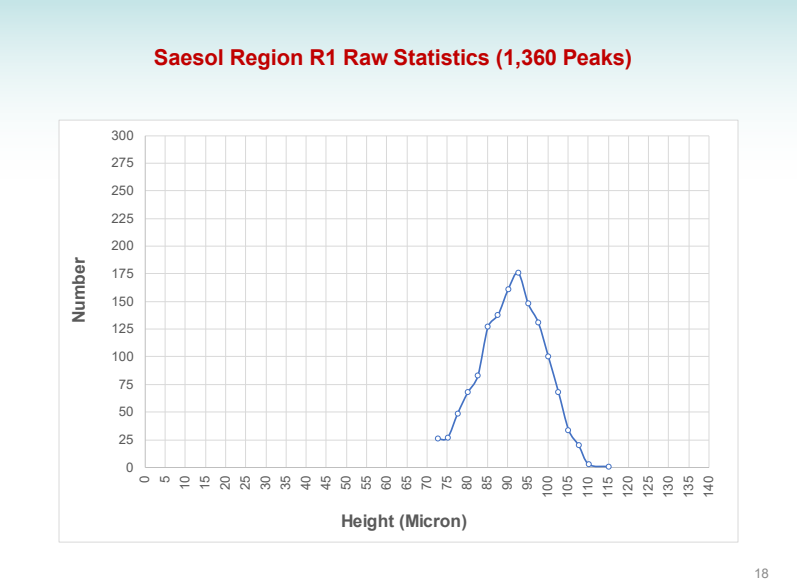
- Saesol PA—Saesol Analysis at 15



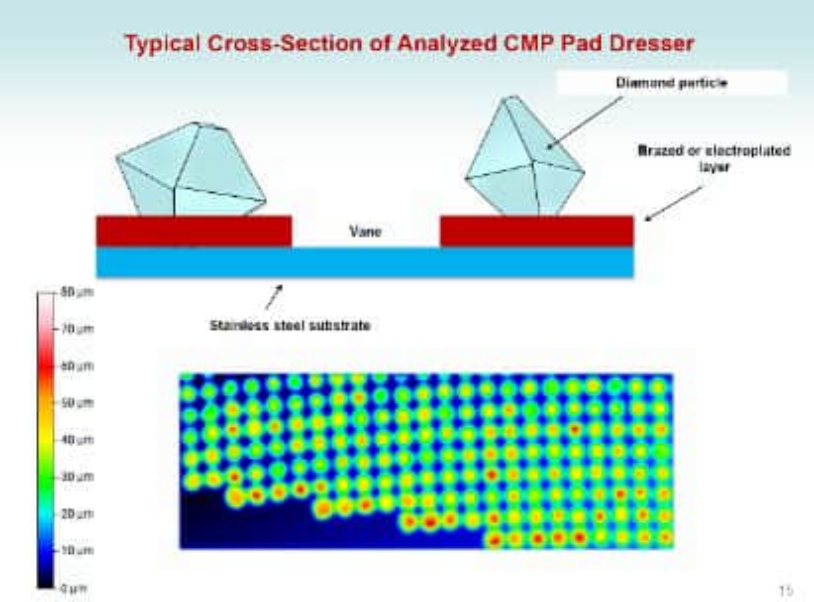
- Saesol PA—Saesol Analysis at 17



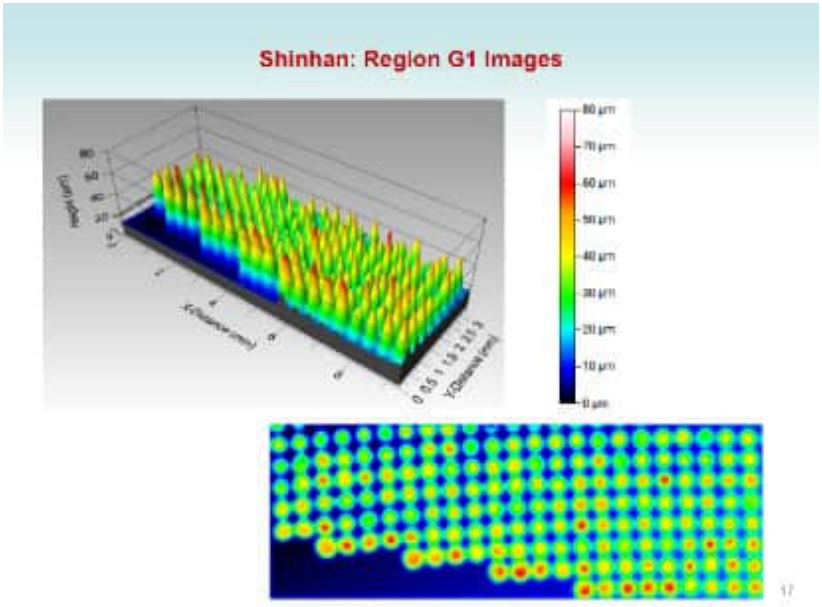
- Saesol PA—Saesol Analysis at 18



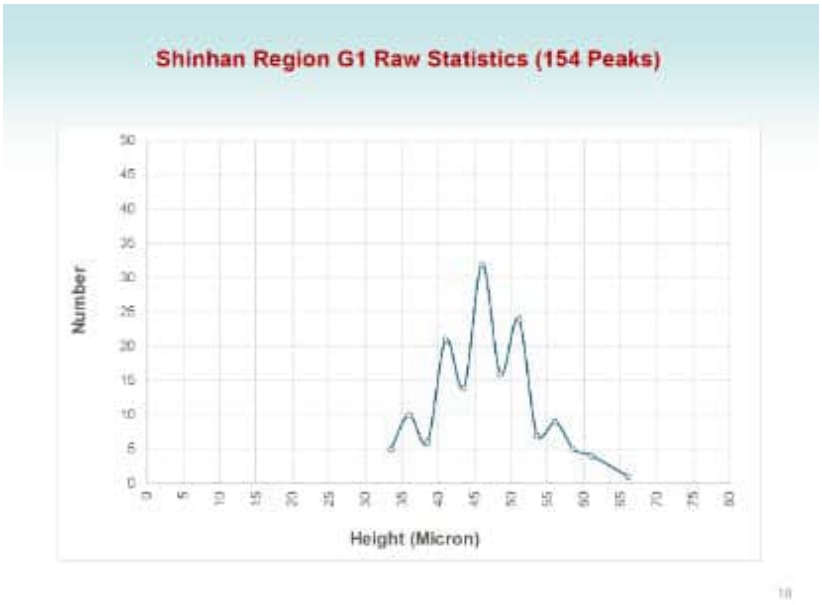
- Shinhan PA—Shinhan Analysis at 15



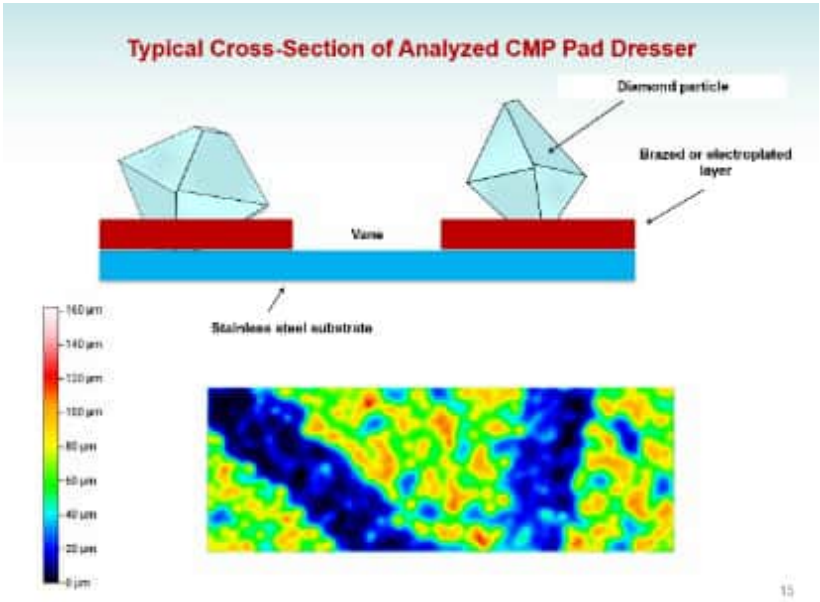
- Shinhan PA—Shinhan Analysis at 17



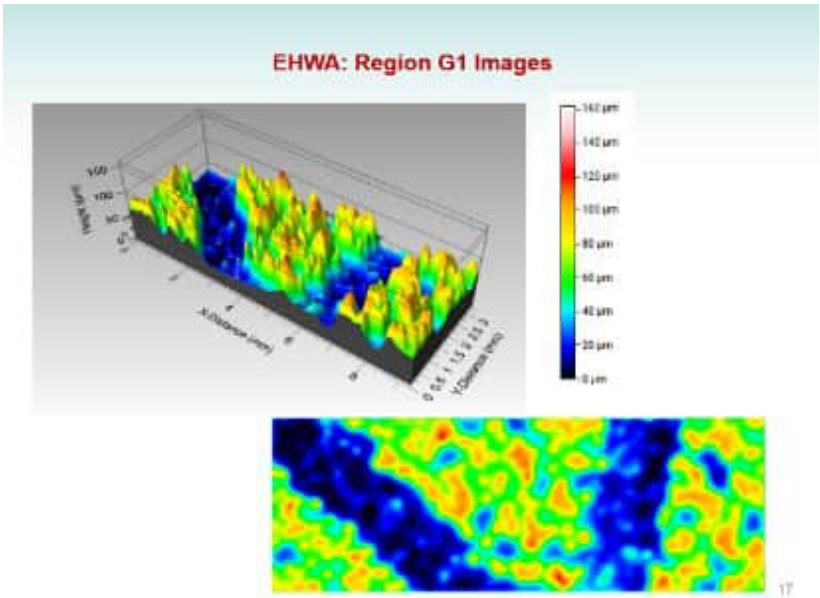
- Shinhan PA—Shinhan Analysis at 18



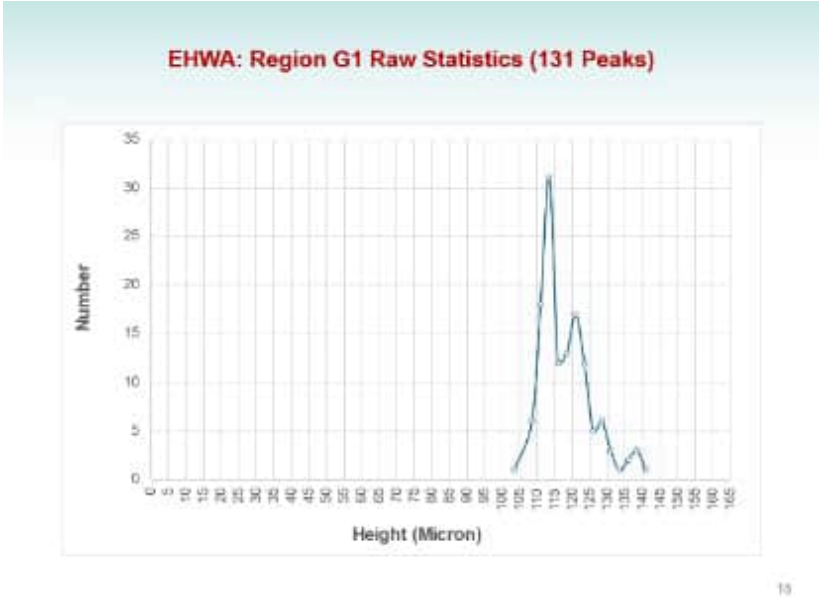
- EHWA PA—EHWA Analysis at 15



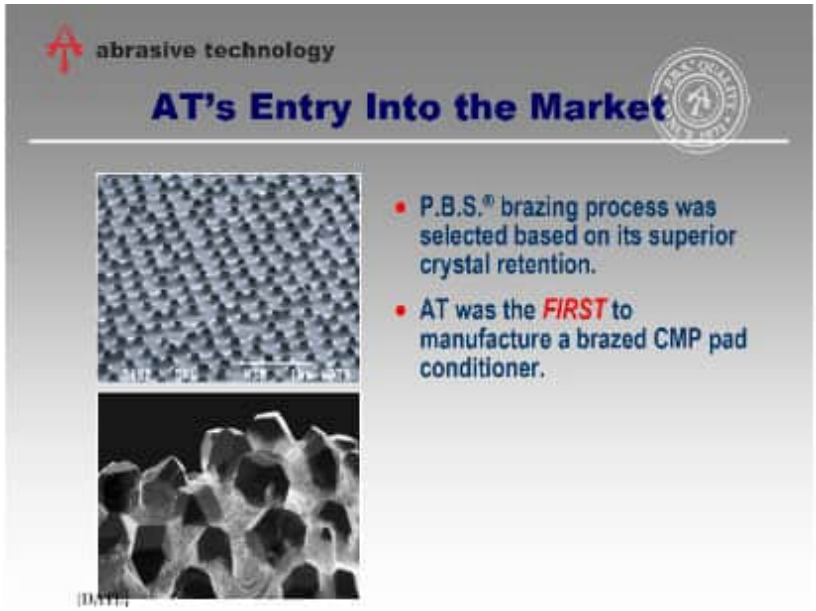
- EHWA PA—EHWA Analysis at 17



- EHWA PA—EHWA Analysis at 18



- ATI PA—AT000093 at 4

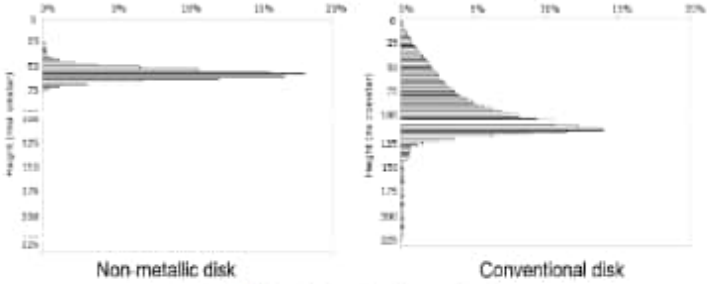


- AT PA—AT000137 at 4

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RESULTS

The chromatic aberration flatness measurement shows the diamond plane of the disk to be very flat. Diamond surface height measurements for a non-metallic disk and a conventional metal substrate disk are shown in Figure 2. The Spk value is a measure of height variation in the diamond plane[9]. The non-metallic disk Spk was 10.25 microns. The Spk for a conventional metal disk was 42.5 microns. This means that one can expect a higher percentage of abrasive particles to effectively condition the polishing surface, leading to lower wafer non-uniformity and longer disk life than with a conventional disk.



- AT PA—AT000280 at 37:



- Smith at 4:16-29 ("In one embodiment**,** a chemical mechanical polishing pad conditioner that comprises a ceramic substrate that has a front surface and a back surface, the ***front surface of the ceramic substrate comprises or includes a first set of ceramic protrusion***s ***formed integrally from the ceramic substrate*** and a second set of ceramic protrusions formed integrally from the ceramic substrate, ***the***

[redacted]

first set of ceramic protrusions can be characterized by a first average height measured from a reference surface, and the second set of ceramic protrusions can be characterized by a second average height measured from the reference surface, the first average height being different from the second average height. In some versions of the invention the first set of ceramic protrusions and the second set of ceramic protrusions each have a top surface. ***The protrusions may further include a layer of polycrystalline diamond.*** In some versions of the pad conditioner the top of each protrusion in the first set of ceramic protrusions has a rough, non-flat surface and a top of each protrusion in the second set of ceramic protrusions has a rough, non-flat surface. The pad conditioner cuts a CMP pad to open pores and create asperities. In some versions of the pad conditioner, the protrusions of each average height are formed in a repeatable pattern across a cutting surface of the pad conditioner. In another version of the pad conditioner the substrate includes ceramic protrusions of second average height that are smaller than the ceramic protrusions of first average height where the ceramic protrusions of second average height are located in an annular region near the outside edge of the substrate. In another version of the pad conditioner the substrate includes ceramic protrusions of two or more heights that are smaller than the ceramic protrusions of first average height where the smaller ceramic protrusions are located in an annular region near the outside edge of the substrate. The ceramic protrusions of lower profile allow the pad conditioner to ease into cutting of the polishing pad and reduces mechanical stress on these protrusions. In some versions of the invention the ceramic protrusions are silicon carbide; in other versions the protrusions are beta silicon

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[redacted]

carbide. Some embodiments of the inventive pad conditioner include a substrate of one or more segments fixtured to a substrate. In some versions of the invention the one or more segments can each have the same protrusions, or the one or more segments can have the same combination of two or more protrusions in each segment. In other embodiments of the invention the segments can each have different protrusions or the segments can have different combinations of two or more protrusions.")

- Ishizuka at Abstract ("Instead of attaching ***individual diamond grits to a metal substrate*** as all pad conditioners are made today, a revolutionary design by ***carving the structure out of a strong polycrystalline diamond (PCD) matrix***. Such Advanced Diamond Disks (ADD) are manufactured by electro discharge machining (EDM) of PCD to form cutting pyramids of a specific size with a designed shape. ADD can produce a much higher density of pad asperities for polishing wafers at high efficiency and with high uniformity. This is a paradigm shift that low pressure CMP is not necessary to avoid damaging of delicate copper circuitry supported by ultra low dielectric constant material.")
- Ishizuka at 5:2-10 ("A revolutionary new design of diamond pad conditioner is now available, this ***advanced diamond disk (ADD) has identical cutting pyramids with tips extended to the same height***. Consequently, ADD can dress pads to achieve unprecedented uniformity in asperities. The furrows are more evenly spaced, the grooves have similar shapes, and there are no killer asperities. All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Fig. 6).").

[redacted]

- Kinik298 at [0050] ("As illustrated in both FIGS. 1B and 2B, in one aspect of the invention, the plurality of individual polycrystalline cutting elements 16 a, 16 b can include at least one cutting tip (18 a and 18 b, respectively), with the cutting tips of the cutting elements being aligned in a common plane (20 a, 20 b, respectively). ***In this example, the common plane is a flat plane of predetermined height above the solidified organic matrix. Thus, the plurality of individual polycrystalline cutting elements can be held within the solidified organic material layer in a very precise manner such that each of the cutting elements contacts a workpiece (not shown) from which material is to be removed at substantially the same depth***. In this way, each of the individual polycrystalline cutting elements can be subject to substantially the same level of drag force as the cutting device is moved relative to a workpiece. This feature of the invention can advantageously limit the premature removal of individual cutting elements that might otherwise shorten the life of the tool, and/or damage the workpiece being treated.").
- Liao at 371 ("The ***pad conditioner is usually a circular metal substrate with polycrystalline diamonds electroplated or brazed on its flat surface***. Zimmer and Stubbmann [2] pointed out that the grit size, crystalline orientation, distribution density, ***amount of protrusion of the diamond***, and the substrate planarity all will affect the dressing rate of the conditioner. Garretson et al [3] investigated the optimal design parameters of the pad conditioner from the viewpoint of wafer removal rate, uniformity and defects on the wafer. They proposed that the conditioner with flatter substrate would result in a better dressing rate. Prabhu et al [4] defined a quantity RAS to assess the sharpness of the dresser. Two quantities A

[redacted]

and B were found to be the significant factors relating to wafer removal rate. However, the quantities A and B were not disclosed.")

- Sung479 at [0069] ("It may also be beneficial for the ***superabrasive particles to protrude from the solidified braze layer*** to a predetermined height or series of heights that is/are along a designated profile. Numerous configurations for designated profiles are possible, depending on the particular use of the superabrasive tool. In one aspect, the designated profile may be a plane. In planar profiles, the highest protruding points of the superabrasive particles are intended to be substantially level. It is important to point out that, though it is preferred that these points align with the designated profile, there may be some height deviation between superabrasive particles that occur due to limitations inherent in the manufacturing process.").
- Kinik2008 at p. 336 ("A revolutionary new design of diamond pad conditioner is now available, ***this Advanced Diamond Disk (ADD) has identical cutting pyramids with tips extended to the same height***. Consequently, ADD can dress pads to achieve unprecedented uniformity in asperities. The furrows are more evenly spaced, the grooves have similar shapes and there are no killer asperities. All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Figure 9).").
- Kinik2008 at p. 340 ("All diamond pad conditioners used today rely on attaching diamond crystals with a matrix, typically made of metal. In contrast, ADD does not need a matrix because it is curved out from a monolithic PCD. The bonding strength of PCD is an order higher than any means of attaching diamond. Consequently, the

[redacted]

risk associated of catastrophic loss of a cutting tip is the least for ADD (Figure 17).")

- Yen at [0043] ("Referring to FIGS. 12 and 13, the pad conditioner **100** formed according to the method of this invention includes: the second substrate **6** having a surface **62**; ***and a plurality of the diamond abrasive grains 4, each of which has a top portion 45 protruding from the surface 62 of the substrate 6***. The top portion **45** has a top end with a height **44** relative to the surface **62** of the substrate **6**. A height difference between a highest one of the top ends of the top portions **45** of the diamond abrasive grains **4** and a lowest one of the top ends of the top portions **45** of the diamond abrasive grains **4** is less than 40 μm. Since the diamond abrasive grains **4** are randomly disposed on the first substrate **11** during preparation of the pad conditioner **100**, probability for each of the sharp corners **913**, **914** and at least one of the {**111**} and {**100**} faces **911**, **912** to enter into the sharp closed end **121** or a lower space of the recess **12** is likely the same. However, by virtue of the shape of the recesses **12**, most of the top ends of the top portions **45** of the diamond abrasive grains **4** of the pad conditioner 100 are the sharp corners **913**, **914**. The percentage of the number of the diamond abrasive grains **4** with the sharp corners **913**, **914** as the top ends can be up to about 90%.")
- Lawing at [0012] ("In an alternate embodiment, the present invention provides a pad conditioner with ***predetermined abrasive particle protrusion length***. This pad conditioner comprises: a substrate; a permanent holding layer attached to the substrate; abrasive particles imbedded in the permanent holding layer (these abrasive particles have a distribution of sizes); and a contact plane at a uniform

distance from the permanent holding layer. ***The abrasive particles of the pad conditioner protrude and extend from the permanent holding layer to define the contact plane at a uniform distance from the permanent holding layer***.")

- Lawing at [0022] ("The pad conditioner, and the process of making the pad conditioner, as described here provides an abrasive surface in which the abrasive particles are at a precisely controlled height relative to a reference plane. Abrasive particles of different sizes can be accurately aligned at the same protrusion height, or alternatively, a protrusion height distribution can be designed with abrasive particles of the same or differing sizes. The abrasive particle height is precisely controlled by placing the abrasive particles on a flat surface and fixing them in place with a temporary sacrificial material, before a permanent holding layer is deposited. Multiple layers of sacrificial material can be built up to provide a multi-modal height distribution. ***The abrasive particles are ultimately fixed in place permanently with a matrix material. After the matrix material has been attached to a substrate,*** the sacrificial material, which defines the protrusion height, can be removed.")
- Tian at [0013] ("In another embodiment, a conditioning element for conditioning a processing pad includes a disk-shaped body having a face ***and a plurality of diamond particles disposed on the face*** and defining a conditioning surface having a flatness of between about −10 and about 50 μm. The diamond particles are of a type selected from the group consisting of very blocky (4D), blocky (3D), and irregular (2D), and have a shape ratio less than or equal to 1.2. The diamond particles have an average size of between about 85 and about 115 μm and the

[redacted]

standard of deviation of the size of the diamond particles is less than about 5 μm. The diamond particles have a spacing of greater than 400 μm and a distribution of between about 251 and about 261 particles per square cm. ***The diamond particles protrude between about 35 and about 65 μm from the face of the body and an uppermost portion of each of the diamond particles are leveled to within a range of between about 30 and about 50 μm***.")

- Tian at [0037]-[0039] ("FIGS. 3A and 3B respectively depict a cross sectional view and a bottom view of one embodiment of the conditioning element 208. ***The conditioning element 208 generally comprises a body 310 having a conditioning surface 300 formed thereon***. The conditioning surface 300 is formed on a face 301 of the body 310. ***A back 320 of the body 310 interfaces with the backing plate 250*** in a manner that maintains the conditioning surface 300 relatively flat, e.g., co-planar, with respect to the polishing material 128 to be conditioned. The body 310 may have one or more threaded holes 322 formed in the back 320 to facilitate coupling to the backing plate 250 via screws, threaded extensions, or the like. In the embodiment depicted in FIGS. 3A-B, three threaded holes 322 are formed along a diameter of the body 310. Alternatively or in combination, one or more threaded holes 326 may extend partially through the body 310 from the back 320 along a periphery of the body 310 to facilitate coupling to the backing plate 250 via screws, threaded extensions, or the like. In the embodiment depicted in FIGS. 3A-B, three threaded holes 326 are substantially evenly spaced near a peripheral edge of the body 310. In addition, one or more apertures 324 may be formed in the back 320 of the body 310 to facilitate alignment with a feature, such as a locating pin (not

[redacted]

shown) that extends from the backing plate 250 of the conditioning head assembly 202. In the embodiment depicted in FIGS. 3A-B, two apertures 324 are disposed on opposing sides of the body 310. ***The body 310 may be fabricated from any process compatible material, such as metals, alloys, ceramics, and the like. In one embodiment, the body comprises stainless steel***. The body 310 may further comprise multiple layers that together form the conditioning element 208. For example, an upper layer 311 may have the conditioning surface 300 formed thereon and may be bonded or otherwise secured to a base layer 309 to form the body 310 of the conditioning element 208. Optionally, a protective coating may be formed over at least a portion of the face 301 of the body 310. The coating protects the body 310 from exposure to the process chemistry (e.g., slurry and/or electrolyte) to extend the useful life of the conditioning element 208. The protective coating may comprise an extremely hard material such as diamond, diamond-like carbon (e.g., α-carbon), cubic boron nitride, and the like.")

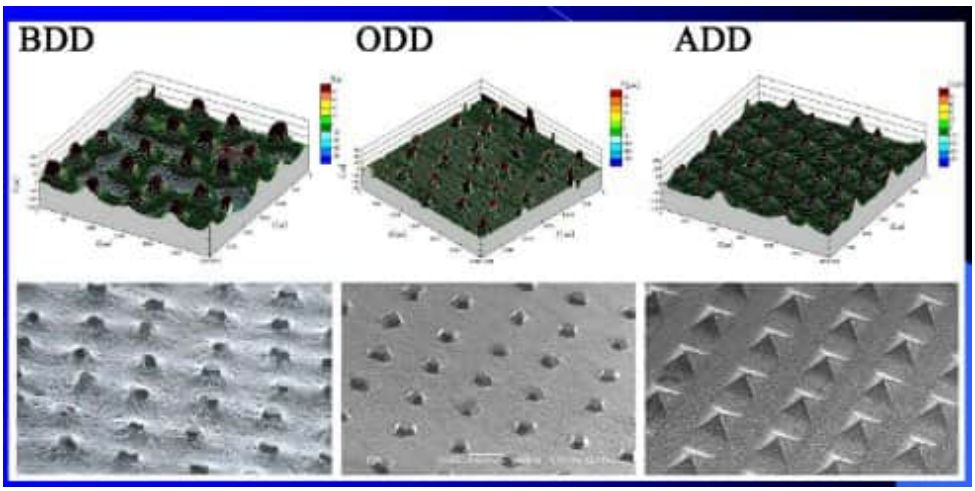
- CMPUG2009 at Slide 2:



- CMPUG2009 at Slide 3:



- CMPUG2009 at Slide 12:



- AT2006 at AT000139 ("Presented here is a CMP conditioning disk having an ultra-flat conditioning plane, achieved by using an ultra-flat ***ceramic substrate*** and proprietary manufacturing techniques. Engineered high-quality ***diamond is bonded to the ultra-flat ceramic substrate using a ceramic bonding matrix***. The body of the conditioner is a 4.25" diameter PVC holder, with fitting
- attachments on the backside. An intimate interface is formed between the ceramic disk and PVC holder to ensure a smooth transition between the two materials. Initial designs were based on Applied Materials Mirra CMP platform in universal format.")
- AT2006 at Fig. 2:

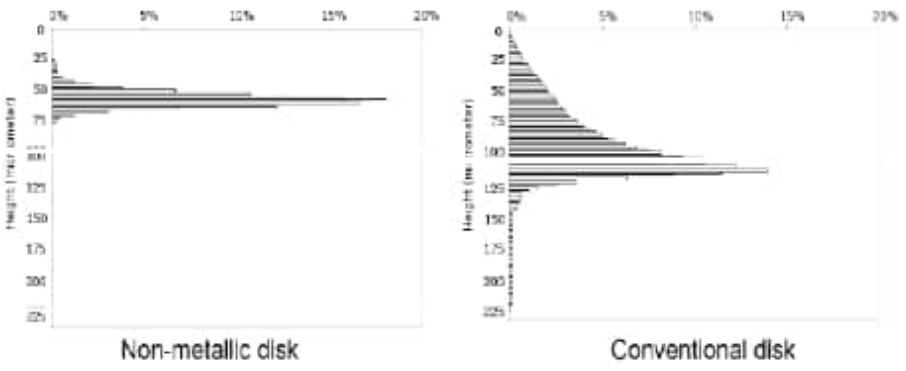


Figure 2. White light chromatic aberration topography measurement histograms.

- Kinik869 at [0016] ("The present invention also provides tools having ***superabrasive particles embedded in an organic matrix***. In one aspect, for example, a superabrasive tool having improved superabrasive particle retention is provided. Such a tool may include a solidified organic material layer, and a plurality of superabrasive particles secured in the solidified organic material layer such that the organic material layer wicks up ***protruding portions of the superabrasive particles***.")
- Kinik869 at [0091] ("***One example of a tool incorporating a single layer of superabrasive particles in an organic material matrix is a CMP pad dresser***. As recited herein, traditional metal matrix CMP pad dressers are not suitable for bonding very small superabrasive particles. It is intended that the scope of the present invention include superabrasive particles of all conceivable sizes that would be useful in dressing a CMP pad. Aspects of the present invention, however, specifically allow the retention of superabrasive particles in a CMP pad dresser of sizes that have not previously been feasible for use in metal tools with particles exposed and arranged in a pattern.")
- *See also* EX862-12 (limitation 1(b)); EX802-13 (limitations 1(a), 1(b), 1(c))

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4. Maintaining Similar Protrusion Distances Between The Tips Of Superabrasive Particles Relative To Designated Profile Were Well-Known.

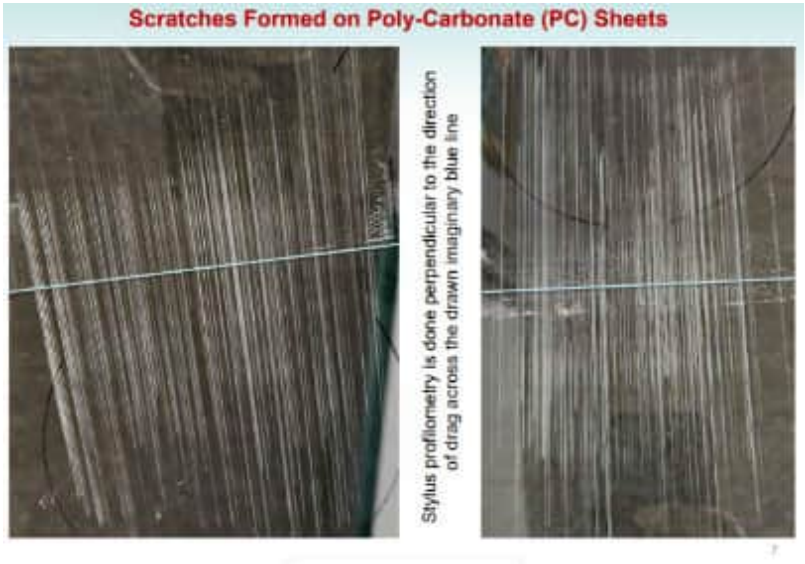
Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 and '802 Patents, it was well known in the art long before the respective priority dates of the '862 and '802 Patents that a CMP pad dresser may be engineered such that protruding heights of superabrasive particles on the rigid support substrate are controlled. It was also well known that the protrusion distances of the superabrasive particles may be controlled such that the differences in their protrusion distances fall within a narrow range. For example, it was well known in the art that the difference in the protrusion distance between the highest and second highest protruding tips may be less than or equal to about 10 microns, or less than or equal to about 50 microns. Similarly, it was well known in the art that the difference in the protrusion distance between the highest 10 protruding tips is less than or equal to about 20 microns; the difference in the protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles is within about 80 microns or less; the difference in the protrusion distance between the highest and 10th highest protruding tips is less than or equal to about 20 microns; and/or the highest protruding tip and the 100th highest protruding tip is less than or equal to about 40 microns. Moreover, it was well-known that the superabrasive particles' tips may be aligned along a designated profile with a tip variation from about 5 to about 100 microns; from about 10 to about 50 microns; from about 20 to 40 microns; or less than about 20 microns. A variety of designated profiles were well known as well, such as a plane, a slope, a curved shape, a dome shape, and a combination thereof.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, limitations 1(c) and 1(d) of Exhibits 862-1 through 862-12; and limitations 1(d), 1(e),

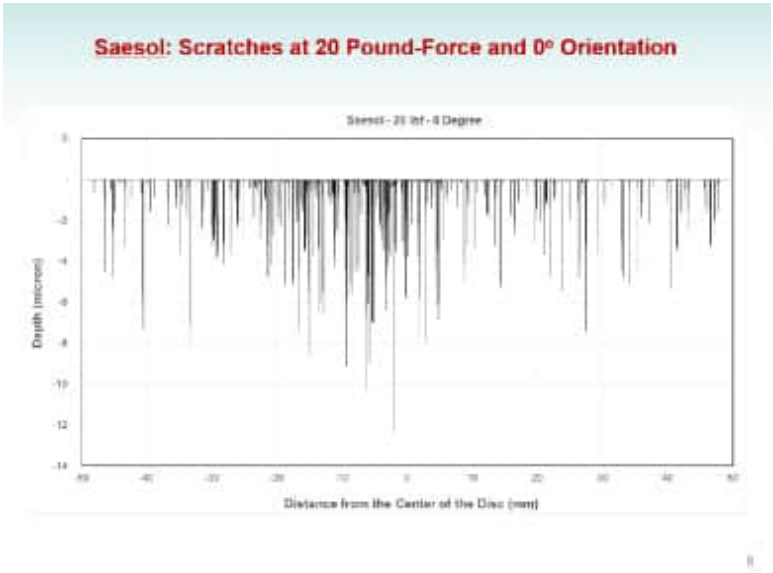
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1(f) of Exhibits 802-1 through 802-13, claims 2–3 of Exhibits 802-1 through 802-5, 802-7 through 802-9, and 802-12 through 802-13, claim 4 of Exhibits 802-1 through 802-9 and 802-12 through 802-13, claim 5 of Exhibits 802-1 through 802-13, claim 13 of Exhibits 802-1 through 802-3, 802-5 through 802-10, and 802-12 through 802-13, claim 14 of Exhibits 802-1 through 802-11, and 802-13, claim 15 of Exhibits 802-1 through 802-9 and 802-12 through 802-13, and claim 19 of Exhibits 802-1 through 802-13 provide numerous examples of references (collectively, the "Protrusion/Profile References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Sung479, Kinik2008, Yen, Lawing, Tian, CMPUG2009, AT2006, and Kinik869—that teach using superabrasive particles whose protrusion distances are controlled such that the differences in their protrusion distances fall within a narrow range, and/or aligning the superabrasive particles' tips along a designated profile (of various shapes) with a tip variation, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in limitations limitation 1(c) and 1(d) of Exhibits 862-1 through 862-12; and limitations 1(d), 1(e), 1(f) of Exhibits 802-1 through 802-13, claims 2–3 of Exhibits 802-1 through 802-5, 802-7 through 802-9, and 802-11 through 802-13, claim 4 of Exhibits 802-1 through 802-9 and 802-12 through 802-13, claim 5 of Exhibits 802-1 through 802-13, claim 13 of Exhibits 802-1 through 802-10, and 802-12 through 802-13, claim 14 of Exhibits 802-1 through 802-11, and 802-13, claim 15 of Exhibits 802-1 through 802-9 and 802-12 through 802-13, and claim 19 of Exhibits 802-1 through 802-13 in demonstrating that this concept was well-known.

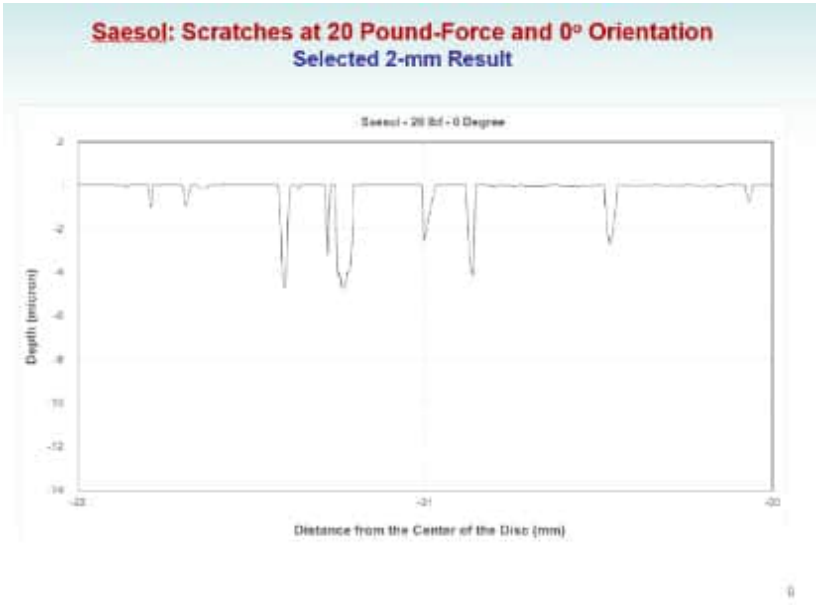
- Saesol PA—Saesol Analysis at 7



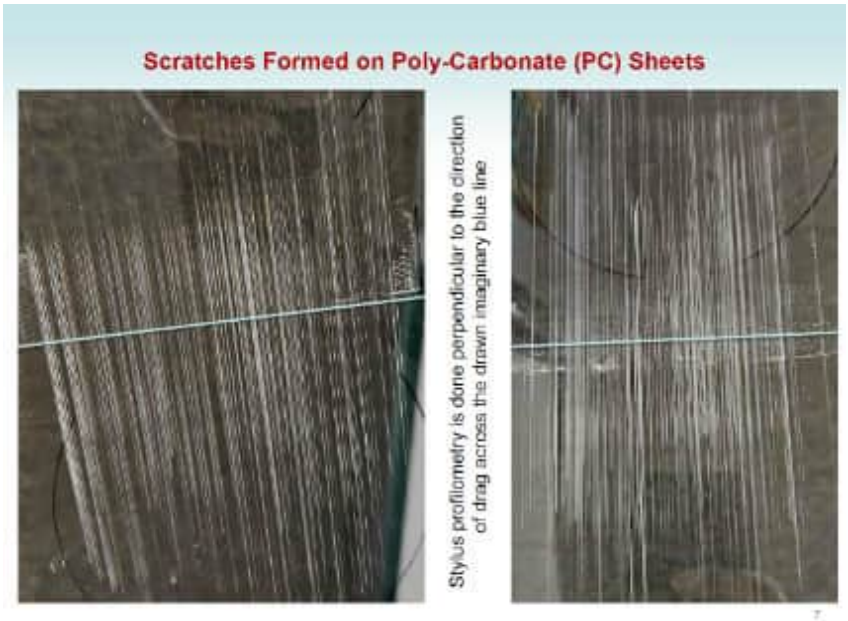
- Saesol PA—Saesol Analysis at 8



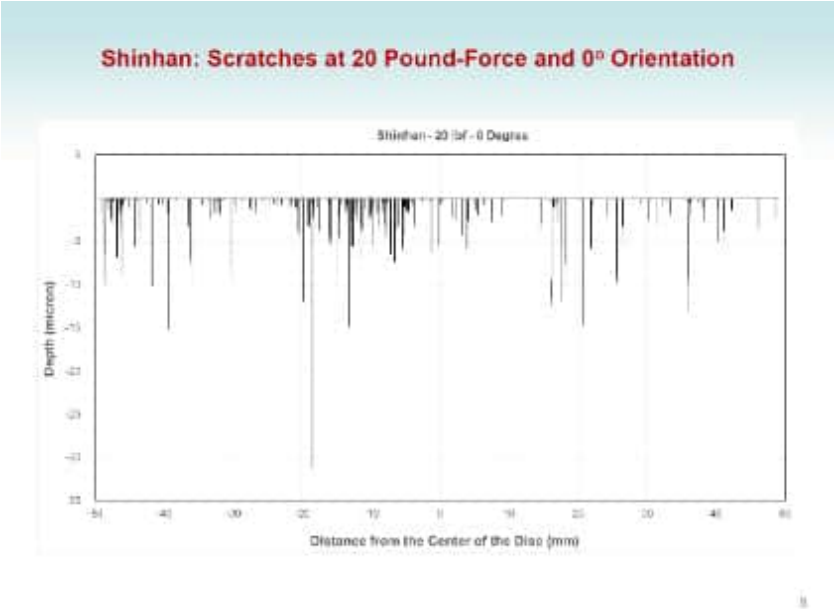
- Saesol PA—Saesol Analysis at 9



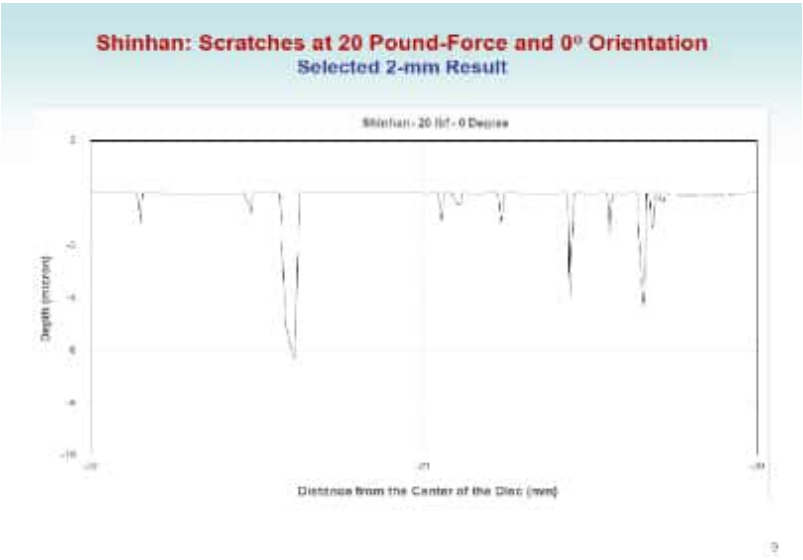
- Shinhan PA—Shinhan Analysis at 7



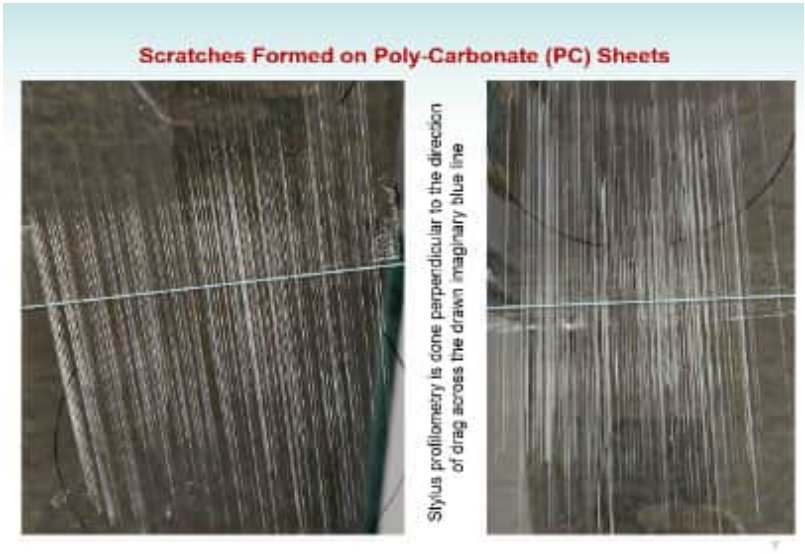
- Shinhan PA—Shinhan Analysis at 8



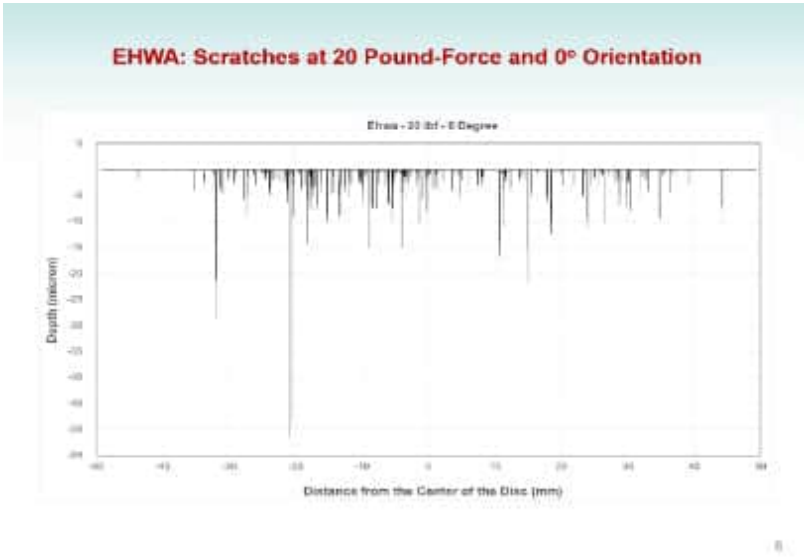
- Shinhan PA—Shinhan Analysis at 9



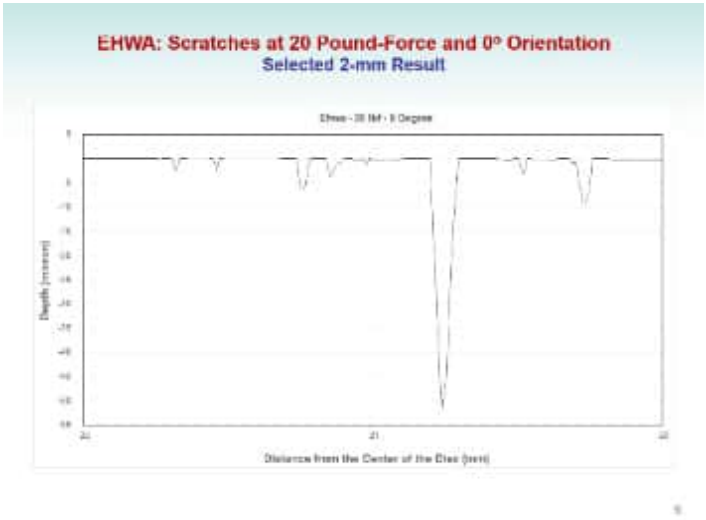
- EHWA PA—EHWA Analysis at 7



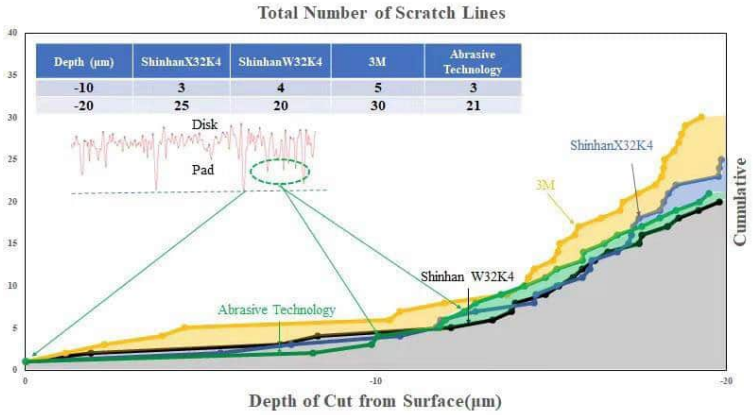
- EHWA PA—EHWA Analysis at 8



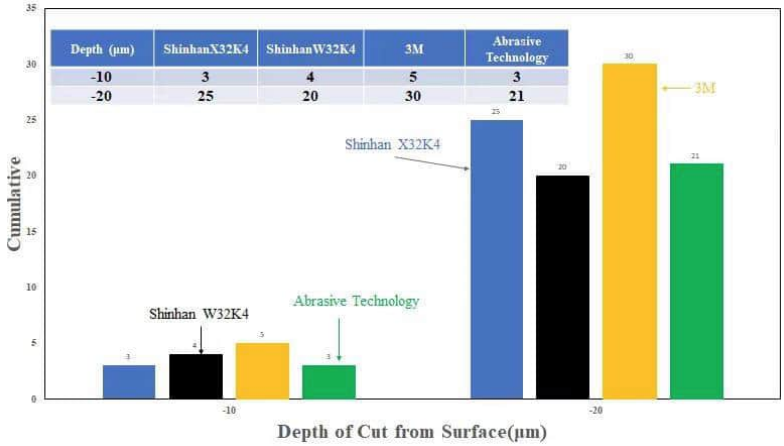
- EHWA PA—EHWA Analysis at 9



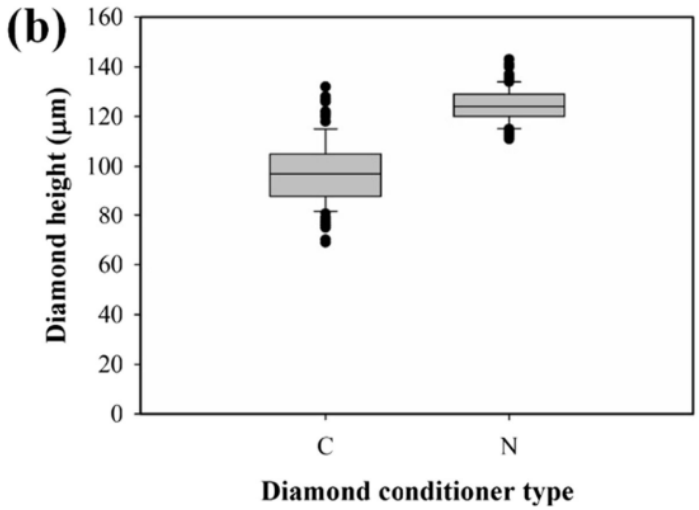
- 3M PA and ATI PA—Compl., D.I. 1, Ex. 9 at 10



- 3M PA and ATI PA—Compl., D.I. 1, Ex. 9 at 11



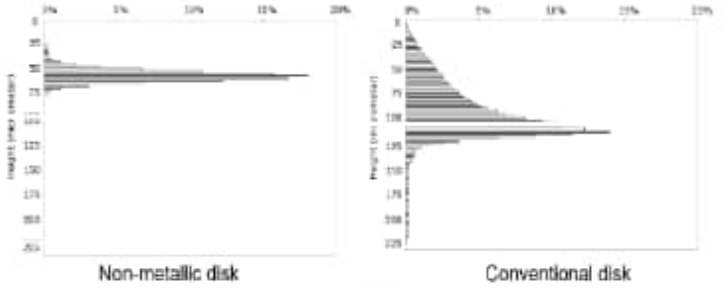
- 3M PA and ATI PA—SAMSUNG_CMS_006552



- ATI PA—AT000137 at 4

RESULTS

The chromatic aberration flatness measurement shows the diamond plane of the disk to be very flat. Diamond surface height measurements for a non-metallic disk and a conventional metal substrate disk are shown in Figure 2. The Spk value is a measure of height variation in the diamond plane[8]. The non-metallic disk Spk was 10.25 microns. The Spk for a conventional metal disk was 42.5 microns. This means that one can expect a higher percentage of abrasive particles to effectively condition the polishing surface, leading to lower wafer non-uniformity and longer disk life than with a conventional disk.



- ATI PA—AT000280 at 37:

[redacted]



- Smith at 20:15-21:13 (“Each of the protrusions of the first and second sets 212 and 214 can be characterized as having a distal extremity 215 (FIG. 11B). ***The first set of protrusions 212 can have distal extremities 215 that are within a first variance 220 of a first registration plane 222, the first registration plane 222 being substantially parallel to the front surface 218***. Herein, a ***"variance" is defined as a height difference between the highest and the lowest distal extremity of a set of protrusions, the height being defined as normal to a registration plane***. In one embodiment, the first set of protrusions 212 are located proximate the first registration plane 222 in a fixed and predetermined relationship relative to each other. The second set of protrusions 214 can include distal extremities 215 that are within a second variance 226 of a second registration plane 228, the second registration plane 228 being substantially parallel to the front surface 218, the second set of protrusions 214 being located on the second registration plane 228 in a fixed and predetermined relationship relative to each other. The first and second

registration planes 222 and 228 are also referred to, respectively, as the "upper" and "lower" registration planes, "upper" meaning that it is furthest from the floor 218 of the substrate 210. It is noted that the first set of protrusions 212 extend through the second ("lower") registration plane 228; therefore, there can also be in a fixed and predetermined relationship between the first and second sets of protrusions 212 and 214 on the second registration plane 228. The first registration plane 222 can be characterized as being nominally offset from the second registration plane 228 in the frontal direction 216 by an offset distance 232 that is greater than either the first variance 220 or the second variance 226. The offset distance 232 can be characterized as being greater than a multiple or factor of either variance 220 or 226, or as a fixed dimension or range of dimensions. ***A typical and non-limiting range of dimensions for the variances 220, 226 is 5 µm to 50 µm. In some embodiments, the variances 220, 226 can range from 10 µm to 25 µm. The variances 220, 226 can also be characterized as being greater than a minimum value and less than a maximum value. Typical and non-limiting multiples or factors of the variances 220, 226 for the offset distance 232 is greater than 1 or 2. Typical and non-limiting values for the offset distance 232 range from 10 µm to 80 µm.***")

- Smith at 24:14-31 ("Referring to FIG. 15, a graph 270 depicting example statistical distributions 272a and 272b of the prominence heights of the major and minor protrusions height variation, respectively, is presented for an embodiment of the invention. Each statistical distribution 272a and 272b can be said to represent two distinct protrusion populations 274a and 274b, respectively. In this non-limiting

[redacted]

example, ***the statistical distribution of the major protrusions 272a have a central or average prominence height 276a of about 50 µm, whereas the statistical distribution of the minor protrusions 272b have a central or average height 276b of about 35 µm. The standard deviation of these particular distributions is on the order of about 5 µm. Example and non-limiting ranges for the standard deviation are on the order of 1 µm to 20 µm***. A "combined" normalized distribution 282 is also presented in FIG. 15, combining and normalizing both protrusion populations 274a and 274b. The combined normalized distribution 282 can be characterized as a bimodal distribution, with a ***first local maxima at about 40 µm and a second local maxima that is slightly less than 50 µm***. The distinction and separation distance between the peaks of a combined normalized distribution 282 will generally be greater as the separation between the individual protrusion populations 274a and 274b increases. Where the separation is sufficiently small, the combined distribution can merge into a single modal distribution having just one peak (not depicted).")

- Ishizuka at 5:2-10 ("A revolutionary ***new design of diamond pad conditioner is now available, this advanced diamond disk (ADD) has identical cutting pyramids with tips extended to the same height***. Consequently, ADD can dress pads to achieve unprecedented uniformity in asperities. The furrows are more evenly spaced, the grooves have similar shapes, and there are no killer asperities. All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Fig. 6).")
- Ishizuka at Fig. 11:

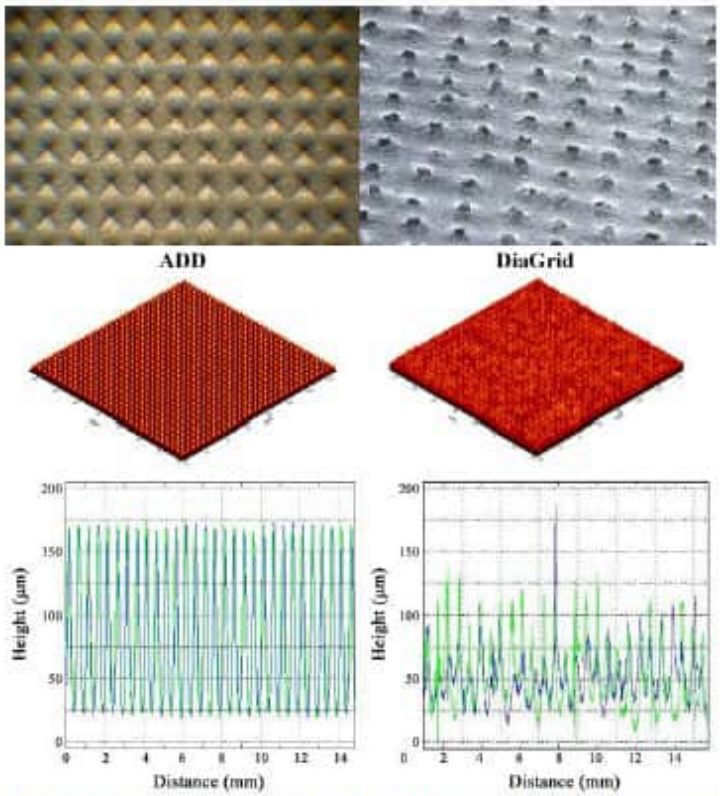


Fig. 11: The vivid comparison of the cutting tips between ADD and DiaGrid® pad conditioner confirms that the former is far superior than the latter in dressing the pad for making semiconductors with virus sized transistors.

- Kinik298 at [0061] ("It may also be beneficial for the cutting elements to protrude from the solidified organic material layer to a prede***termined height or series of heights that is/are along a designated profile***. Numerous configurations for designated profiles are possible, depending on the particular use of the abrading tool. In one aspect, the designated profile may be a plane. ***In planar profiles, the highest protruding points of the cutting elements are intended to be substantially level***. It is important to point out that, though it is preferred that these points align with the designated profile, there may be some height deviation between cutting elements that occur due to limitations inherent in the manufacturing process.").

[redacted]

- Kinik298 at [0067] ("In another aspect, the plurality of cutting elements are arranged such that their tips vary from the designated profile by from about 20 microns to about 40 microns. Additionally, in one aspect, they are arranged such that their tips vary from the designated profile by less than about 20 microns. In another aspect, they are arranged such that their ***tips vary from the designated profile by less than about 10 microns***. In yet another aspect, they are arranged such that their ***tips vary from the designated profile by less than about 5 microns***. ***In yet another aspect, they are arranged such that their tips vary from the designated profile by less than about 1 micron***. In a further aspect, a majority of the plurality of the cutting elements are arranged such that their tips vary from the designated profile to less than about 10% of the average size of the cutting elements.").
- Liao at 372 ("***The leveling is defined as the height distribution of the diamonds***. In our experiments, conditioners with two kinds of leveling classified as G (denoting of good) and ***S (representing superior)*** by the manufacturer were used. The ***height distribution of these two conditioners with 700μm diamond separation is plotted in Fig. 2(a)***. It can be seen that for G grade conditioner, there are a few diamonds with more protrusion, and hence a tail appeared on the distribution plot. This leveling is bad as compared to the S grade conditioner denoted by the solid line in the figure. Fig. 2(b) shows the height distribution of G and S grade conditioners of the same 500μm diamond separation. There is no apparent difference between two curves. It indicates that the current classification method cannot differentiate the leveling of this specification conditioner.")
- Liao at Fig. 2:

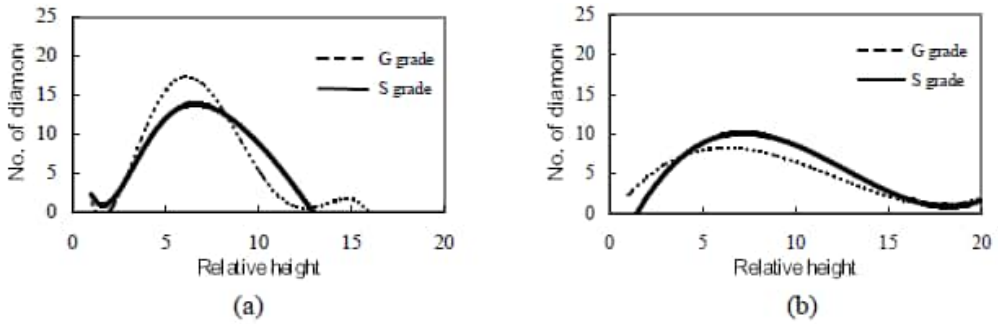


Fig. 2 Leveling of the conditioner for the diamond spacing of (a)700 μm (b) 500 μm .

- Sung479 at [0072] ("As has been mentioned herein, while it is intended that the tips of the superabrasive particles align along the designated profile, some level of deviation may occur. These deviations may be a result of the design or manufacturing process of the tool. Given the wide variety of sizes of superabrasive particles that may potentially be utilized in a given tool, such deviations may be highly dependent on a particular application. 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, whether that point be an apex, an edge, or a face. 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. In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 10 microns to about 75 microns. In a further aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 10 microns to about 50 microns. In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from

[redacted]

the designated profile by from about 50 microns to about 150 microns. In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20 microns to about 100 microns. In a further aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20 microns to about 50 microns. ***In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20 microns to about 40 microns. Additionally, in one aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by less than about 20 microns. In another aspect the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by less than about 10 microns. In yet another aspect, the plurality of superabrasive particles is arranged such that their tips vary from the designated profile by less than about 5 microns. 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***. In a further aspect, a majority of the plurality of superabrasive particles are arranged such that their tips vary from the designated profile to less than about 10% of the average size of the superabrasive particles.").

- Kinik 2008 at p. 336 ("A revolutionary new design of diamond pad conditioner is now available, this ***Advanced Diamond Disk (ADD) has identical cutting pyramids with tips extended to the same height.*** Consequently, ADD can dress pads to achieve unprecedented uniformity in asperities. The furrows are more evenly spaced, the grooves have similar shapes and there are no killer asperities.

[redacted]

All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Figure 9).")

- Kinik2008 at Table 1:

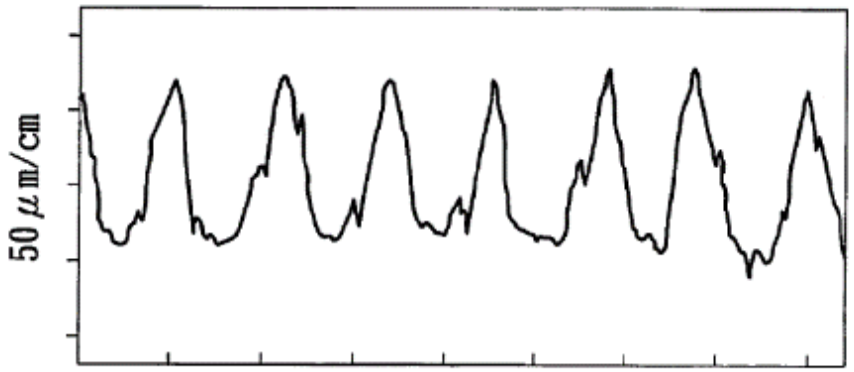
Table 1 The contrasted features of ADD versus DiaGrid

	DiaGrid	*ADD*
Diamond levelling	> 50 μm	< 20 μm
Dressing rate	> 50 μm/hr	> 20 μm/hr
Working crystals	< 10%	> 90%
Brocken crystals	> 20%	< 1%
Diamond shape	Irregular	Symmetrical
Diamond angle	> 100°	< 90°
Dressing stress	Large (Tearing)	Low (Cutting)
Dressing temperature	High	Low
Acid proof	No	Yes
Pad life	Short	Long
Disk life	Short	Long
Asperity	Random	Uniform
Uniformity	Low	High

- Yen at [0013] ("A pad conditioner comprising: a substrate having a surface; and a plurality of diamond abrasive grains, each of which has a top portion protruding from said surface of said substrate, said top portion having a top end with a height relative to said surface of said substrate; wherein ***a height difference between a highest one of said top ends of said top portions of said diamond abrasive grains and a lowest one of said top ends of said top portions of said diamond abrasive grains is less than 40 μm***. ")
- Yen at [0064] ("FIG. 17 is a surface profile measuring graph showing the heights **44** of a portion of the diamond abrasive grains **4** of Example 2 using the surface profile-measuring instrument (MITUTOYO, SURFTEST SV-400). The parameters set for the measurement were the same as those of Example 1. ***The maximum height difference was 15 μm***, which is an indication of relatively

uniform heights **44** for the diamond abrasive grains **4** on the pad conditioner 100 of Example 2.")

- Yen at FIG. 17:

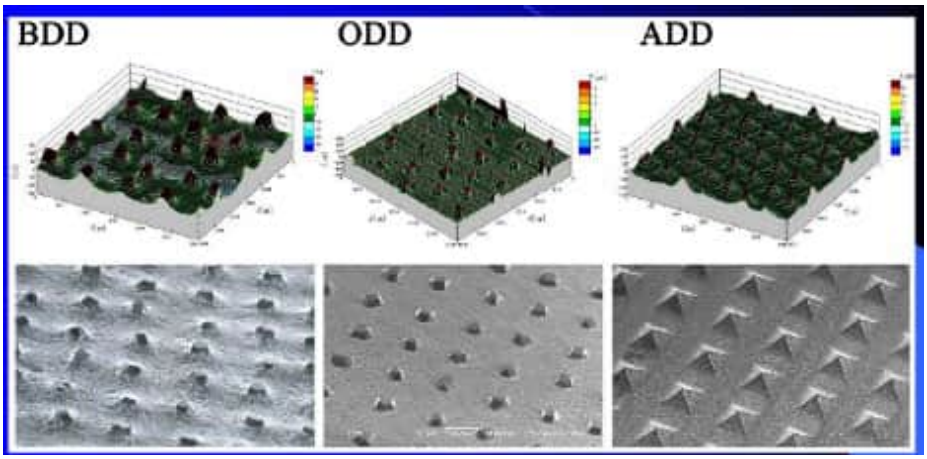


F I G. 17

- Lawing at [0030] ("***Because the uniform distance of the contact plane*** is determined by the thickness of the temporary holding layer, the uniform distance is typically between 20% and 75% of the mean size of the abrasive particles, although ***it may be advantageous to limit the protrusion heights to very small values, between about 0 μm and 10 μm***, for specific applications. The abrasive particles are preferably between about 50 μm and 500 μm in diameter and are uniformly spaced on the permanent holding layer. The abrasive particles may be distributed with a pre-determined distance between the particles, typically about 400-1000 μm center-to-center.")
- Tian at [0045]-[0046] ("***After being secured to the body 310, about 50 percent of the diamond particles 350 generally protrude above the face 301 of the body 310. In one embodiment, the diamond particles 350 protrude between about 35 to***

about 65 µm above the face 301. To facilitate the uniformity of the exposed surface of the diamond particles 350 above the face 301, the diamond particles 350 may have a uniform shape distribution. The uniformity of the diamond particles 350 is typically measured by a shape ratio. The shape ratio compares the height and the width of the diamond particles 350. Having a ratio near 1 ensures that the ***diamond particles 350 will extend the same distance above the face 301 of the body 310*** no matter which way the particles are oriented during fabrication. For example, the diamond particles 350 may be dispersed onto the face 301 of the body 310 and fall in a random configuration. Diamond particles having a similar size as well as a shape ratio near 1 will have a similar height regardless of the orientation of the particles upon coming to rest on the face 301. In one embodiment, the shape ratio of the diamond particles 350 is between about 1 and about 1.2. To further facilitate the ***uniformity of the protrusion of the diamond particles 350 above the face 301***, ***the diamond particles 350 may be leveled, or controlled (e.g., the height of the tips of the diamond particles 350 may be leveled to be more uniform). In one embodiment, the tips of the diamond particles 350 are leveled to have a maximum tip-to-tip variation of between about 30 to about 50 µm. In addition, the conditioning surface 300 has a flat profile,*** for example as measured in multiple locations by a 2 mm diameter probe, ranging from about −30 to about 30 µm.")

- CMPUG2009 at Slide 12:



- AT2006 at AT000140 ("The chromatic aberration flatness measurement shows the diamond plane of the disk to be very flat. Diamond surface height measurements for a non-metallic disk and a conventional metal substrate disk are shown in Figure 2. ***The Spk value is a measure of height variation in the diamond plane[(6)]. The non-metallic disk Spk was 10.25 microns. The Spk for a conventional metal disk was 42.5 microns.*** This means that one can expect a higher percentage of abrasive particles to effectively condition the polishing surface, leading to lower wafer non-uniformity and longer disk life than with a conventional disk.")
- AT2006 at Fig. 2:

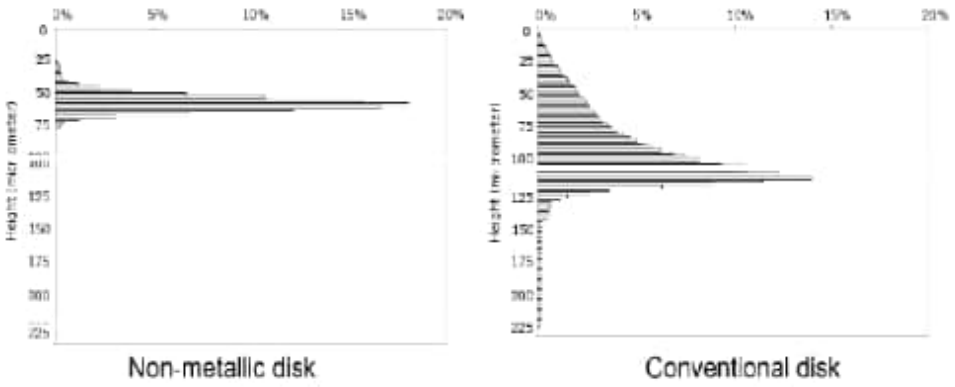


Figure 2. White light chromatic aberration topography measurement histograms.

[redacted]

- Kinik869 at [0060] ("As has been mentioned herein, while it is intended that the tips of the superabrasive particles align along the designated profile, some level of deviation may occur. These deviations may be a result of the design or manufacturing process of the tool. Given the wide variety of sizes of superabrasive particles that may potentially be utilized in a given tool, such deviations may be highly dependent on a particular application. 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***, whether that point be an apex, an edge, or a face. 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. In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 10 microns to about 75 microns. In a further aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 10 microns to about 50 microns. In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 50 microns to about 150 microns. In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20 microns to about 100 microns. In a further aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20

[redacted]

microns to about 50 microns. In another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by from about 20 microns to about 40 microns. ***Additionally, in one aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by less than about 20 microns. In another aspect the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by less than about 10 microns. In yet another aspect, the plurality of superabrasive particles are arranged such that their tips vary from the designated profile by less than about 5 microns. 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 micron.*** In a further aspect, substantially all of the plurality of superabrasive particles are arranged such that their tips vary from the designated profile to less than about 10% of the average size of the superabrasive particles.")

- *See also* EX862-12 (limitations 1(c) and 1(d)); EX802-13 (limitations 1(d), 1(e), 1(f) and claims 2-5, 13-15, 19)

5. Cutting Asperities Into a CMP Pad With A Desired Cutting Depth Were Well Known.

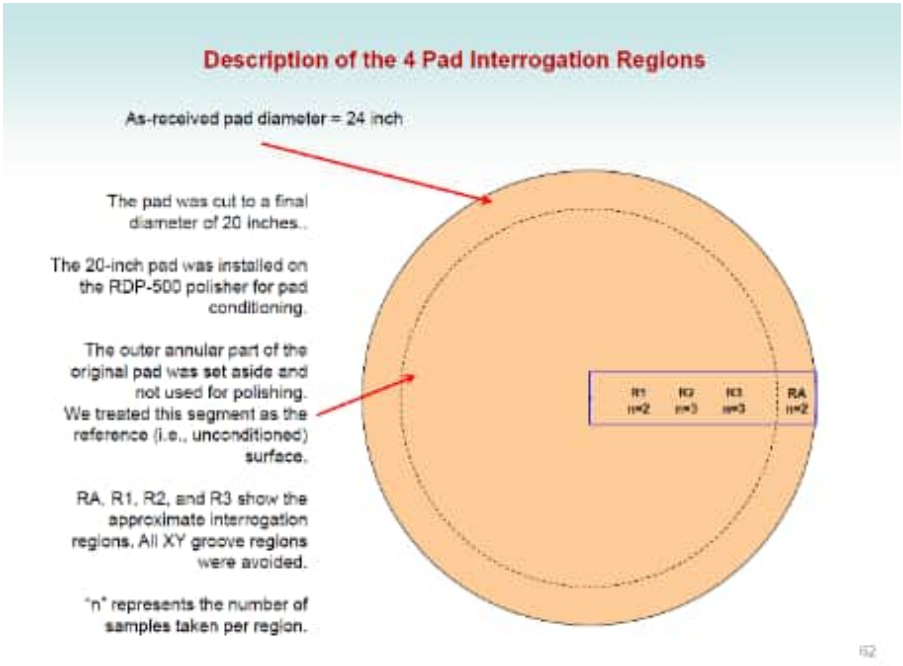
Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 and '802 Patents, rotating a CMP pad dresser against a CMP pad to cut asperities into the CMP pad with various cutting depths was well-known in the art long before the respective priority dates of the '862 and '802 Patents. For example, it was well-known in the art that a CMP pad dresser may be rotated to cut asperities into the CMP pad having a maximum cutting depth of

[redacted]

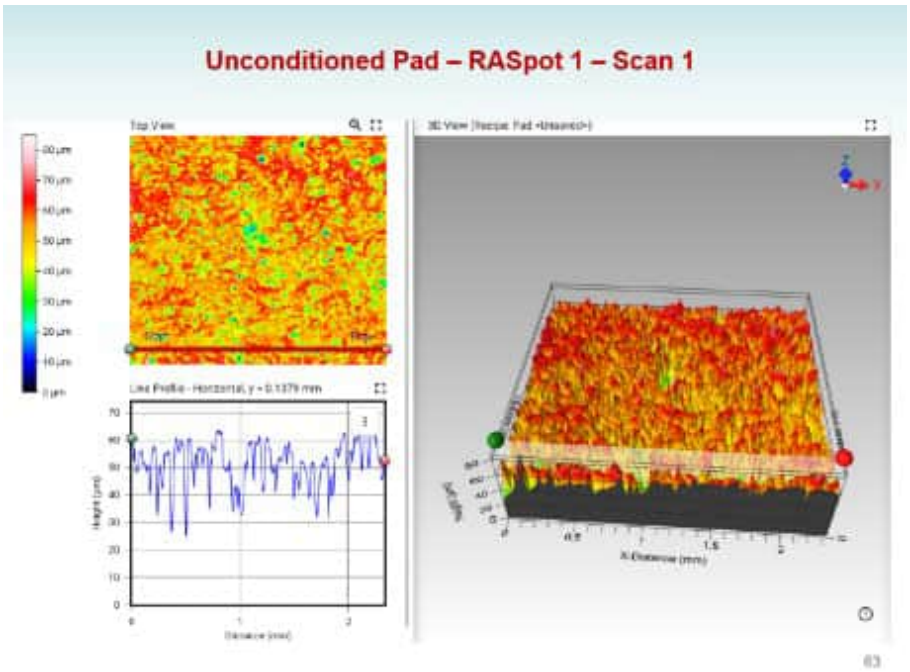
about 60 microns, and having various cutting depths (such as in the range of less than or equal to about 50 microns; about 10 microns to about 50 microns; less than about 20 microns; about 1 micron to about 20 microns; about 10 microns to about 20 microns) were well-known.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, limitations 1(e) and 1(f) of Exhibits 862-1 through 862-12; and claim 6 of Exhibits 802-1 through 802-5, 802-7, 802-11 through 802-13, claims 7, 16–17 of Exhibits 802-1 through 802-5, 802-7, 802-9, 802-11 through 802-13 provide numerous examples of references (collectively, the "Cutting Depth References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Sung479, Kinik2008, Yen, Lawing, Tian, CMPUG2009, AT2006, and Kinik869—that teach rotating a CMP pad dresser against a CMP pad to cut asperities into the CMP pad with various cutting depths, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in limitation 1(e) and 1(f) of Exhibits 862-1 through 862-12; and claim 6 of 802-1 through 802-5, 802-7, 802-11 through 802-13, claims 7, 16–17 of Exhibits 802-1 through 802-5, 802-7, 802-9, 802-11 through 802-13 in demonstrating that this concept was well-known.

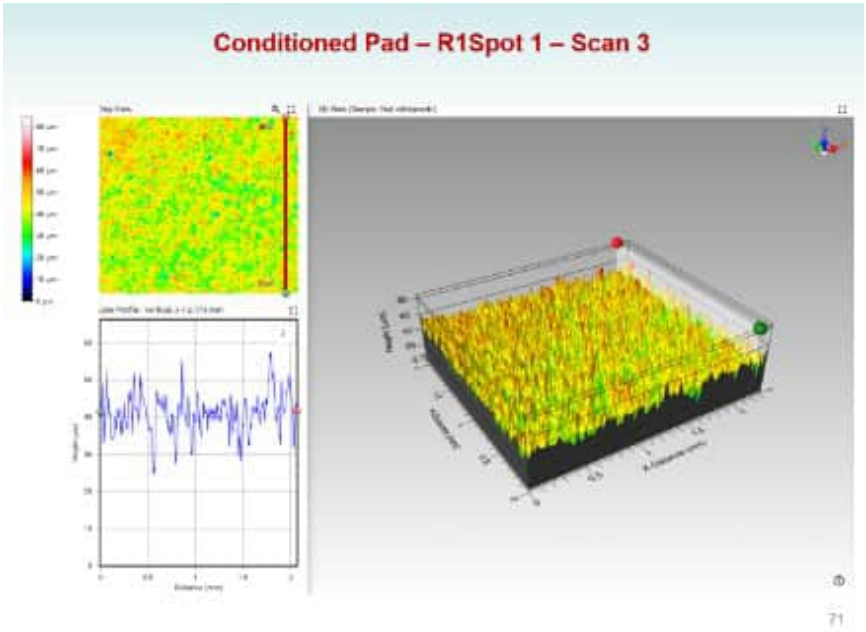
- Saesol PA—Saesol Analysis at 62



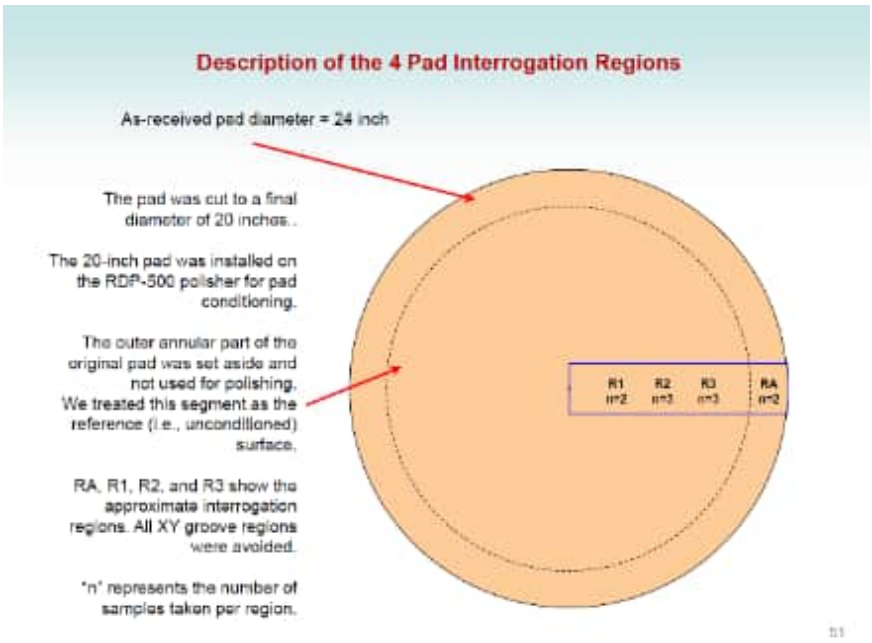
- Saesol PA—Saesol Analysis at 63



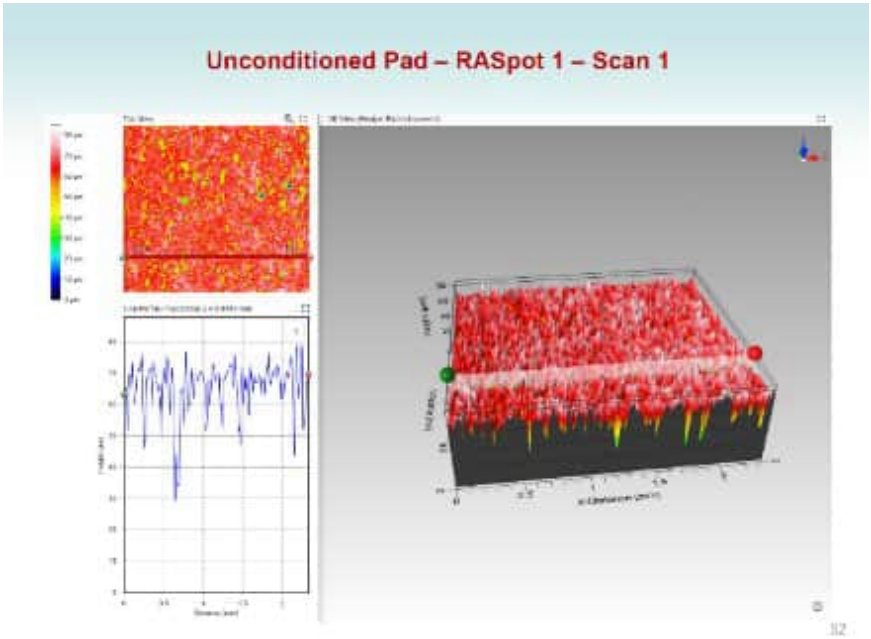
- Saesol PA—Saesol Analysis at 71



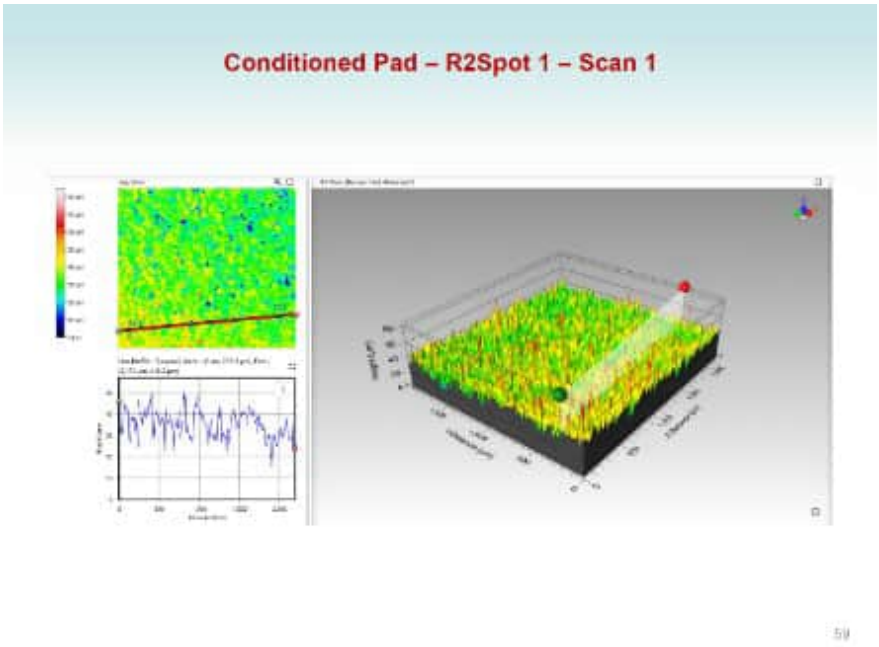
- Saesol PA—Shinhan Analysis at 51



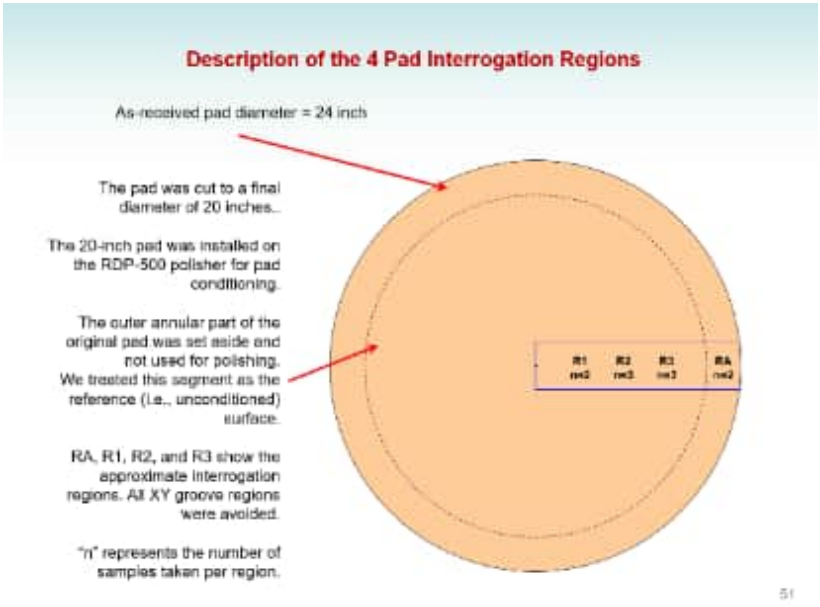
- Shinhan PA—Shinhan Analysis at 52



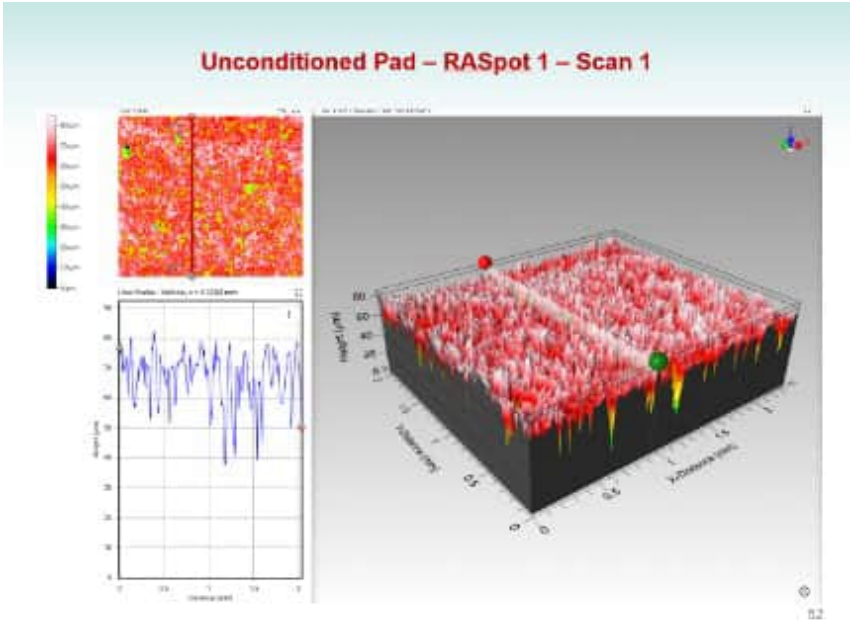
- Shinhan PA—Shinhan Analysis at 59



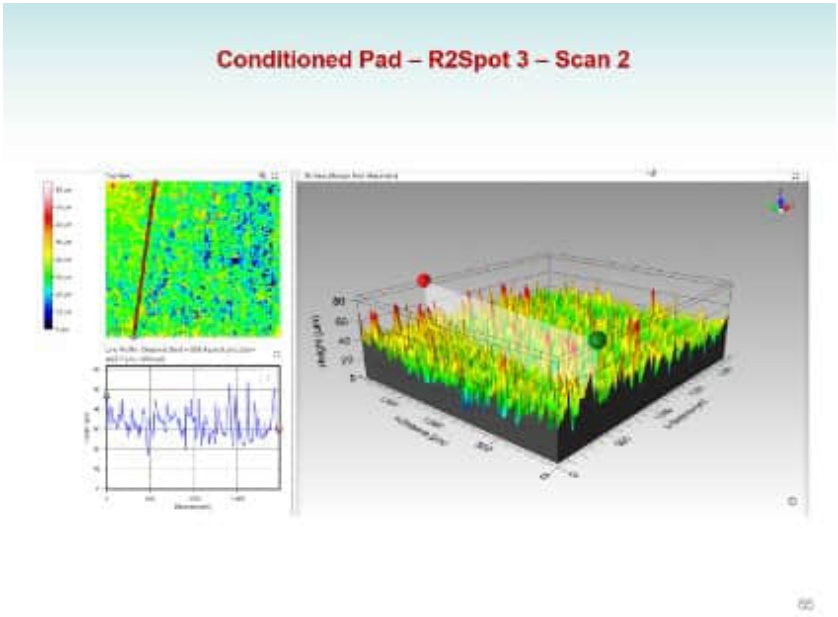
- EHWA PA—EHWA Analysis at 51



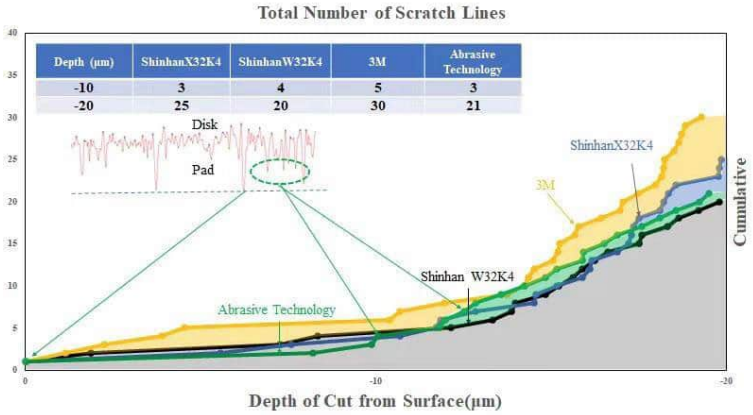
- EHWA PA—EHWA Analysis at 52



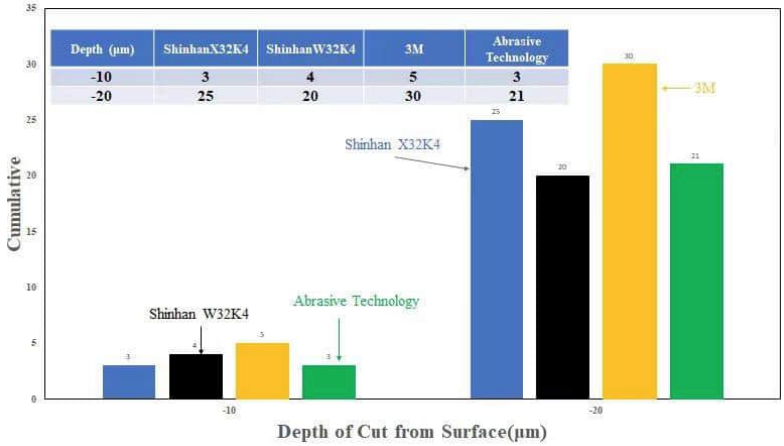
- EHWA PA—EHWA Analysis at 65



- 3M PA—Compl., D.I. 1, Ex. 9 at 10

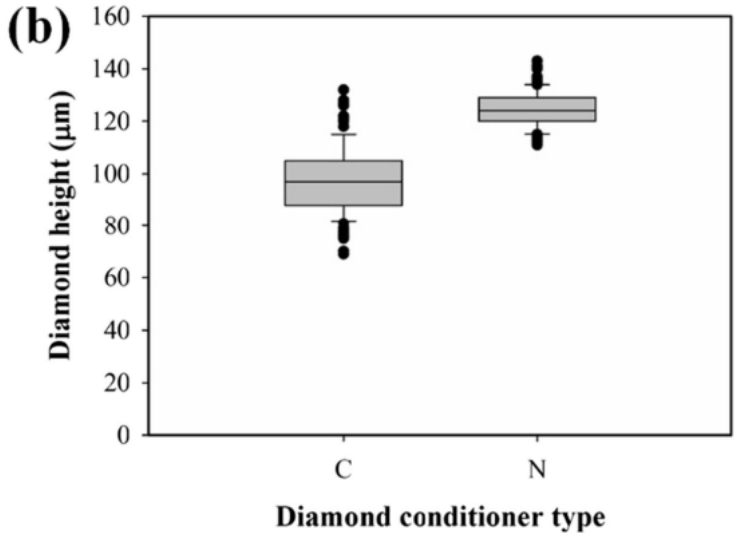


- 3M PA—Compl., D.I. 1, Ex. 9 at 11



[redacted]

- 3M and ATI PA—SAMSUNG_CMS_006552



- ATI PA—AT000280 at 30



- ATI PA—AT000280 at 37:

[redacted]



- ATI PA—AT000280 at 38:



- Smith at 27:20-24 ("***The facets of the polycrystalline CVD diamond layer that coat the substrate protrusions provide the cutting action to open pores and create asperities in the CMP pad that is being conditioned***. The protrusions on

[redacted]

the substrate provide a surface on which to deposit the polycrystalline diamond coating and also create force concentrations at the conditioner and pad interface.")

- Smith at 10:2-20 ("Referring now to FIG. 1, a wafer polishing apparatus 30 with a pad conditioner 32 in a chemical mechanical planarization (CMP) process is depicted in an embodiment of the invention. The depicted wafer polishing apparatus 30 includes a rotation table 34 having an upper face 36 with a CMP pad 38 (such as a polymeric pad) mounted thereon. A wafer head 42 having a wafer substrate 44 mounted thereon is arranged so that the wafer substrate 44 is in contact with the CMP pad 38. In one embodiment, a slurry feed device 46 provides an abrasive slurry 48 to the CMP pad 38. In operation, the rotation table 34 is rotated so that the CMP pad 38 is rotated beneath the wafer head 42, pad conditioner 32 and slurry feed device 46. The wafer head 42 contacts the CMP pad 38 with a downward force F. The wafer head 42 can also be rotated and/or oscillated in a linear back-and-forth action to augment the polishing of the wafer substrate 44 mounted thereon. ***The pad conditioner 32 is also in contact with the CMP pad 38, and is translated back and forth across the surface of the CMP pad 38. The pad conditioner 32 can also be rotated.*** Functionally, the CMP pad 38 removes material from the wafer substrate 44 in a controlled manner to give the wafer substrate 44 a polished finish. The function of the pad conditioner 32 is to remove debris from the polishing operation that fills the debris from the CMP process and to open the pores of the CMP pad 38, thereby maintaining the removal rate in the CMP process.")

[redacted]

- Smith at 30:4-11 ("Thus, the polycrystalline CVD diamond coating provides a rough and jagged configuration that conforms to the shape of the underlying substrate and protrusion features, while providing the hardness and durability of polycrystalline CVD diamond. As a result, every surface of the pad conditioner that is in contact with a polishing pad during use is involved in the cutting and surface texturing. In some embodiments, ***the asperities may have an average height in the range of about 0.5 µm to about 10 µm; in other embodiments, the height range of the asperities may range from about 0.5 µm to about 5 µm, and in still other embodiments from about 1 µm to about 3 µm***.")
- Ishizuka at 5:2-10 ("A revolutionary ***new design of diamond pad conditioner is now available, this advanced diamond disk (ADD) has identical cutting pyramids with tips extended to the same height***. ***Consequently, ADD can dress pads to achieve unprecedented uniformity in asperities.*** The furrows are more evenly spaced, the grooves have similar shapes, and there are no killer asperities. All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Fig. 6).")
- Ishizuka at 8:2-31 ("The contrast between ADD and DiaGrid® pad conditioner is dramatic in the global view of optical microscopy, and in the detailed layout of the array as well as the profiling of the ***cutting tips*** as revealed below (Fig. 11). The performance of pad conditioners can be measured by two most critical parameters, the longevity of the pad conditioner and the pad; and the effectiveness of the pad dressing. The longevity can be improved ***by leveling of cutting tips that increases the number of working crystals on the pad conditioner.*** The

[redacted]

effectiveness of the pad dressing may be improved by the sharpness of the cutting tips, the sharper, the faster to create the density of pad asperity as required for polishing. Due to the even loading of the pad and the uniformity of asperities, wafer polishing can be much more uniform. Moreover, because the polishing can only be achieved by the contact between wafer and pad, ADD with more polishing points generated on the pad may polish at a higher removal rate even if the individual polishing rate is low at each contact point. The low-pressure contact at each polishing point will also assure the uniformity of the polish performance (Fig. 12). Due to the seriated feature of PCD surfaces and edges, ADD can cut pads cleaner with less tearing. Moreover, the pad dressed has a higher specific surface area than that dressed by a conventional pad conditioner. The more textured pad surface can trap more abrasive particles on asperities. Consequently, a higher polishing rate of wafer or a reduced usage of slurry may be achieved.")

- Ishizuka at Fig. 2:

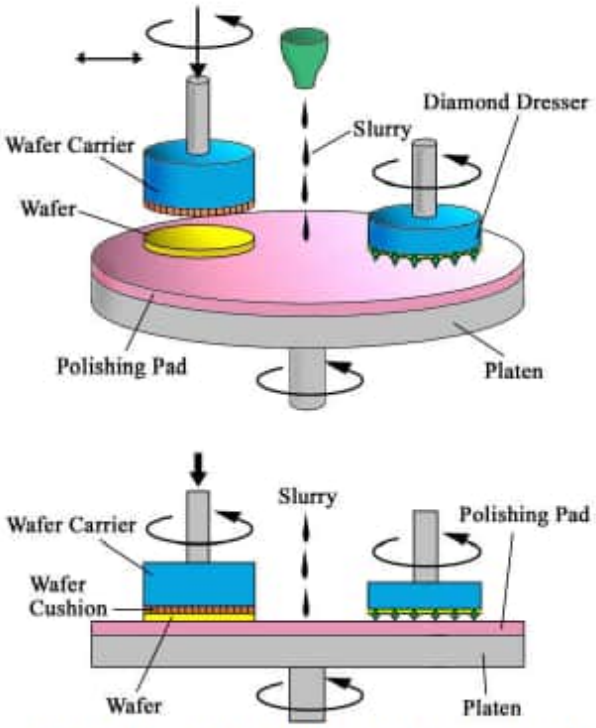


Fig. 2: The CMP layout includes a rotating pad, a feeding slurry, and a rotating pad conditioner.

- Ishizuka at Fig. 16:

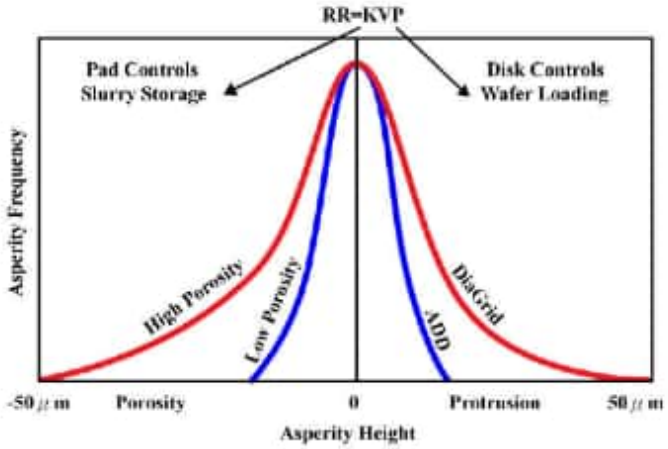


Fig. 16: The pressure distribution under wafer is determined by the uniformity of asperities' tip heights. ADD is uniquely capable to form dense, but uniform polishing points that can expedite the CMP process without causing damage.

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[redacted]

- Kinik298 at [0062] ("In addition to planar profiles, in another aspect of the present invention the designated profile has a slope. Tools having sloping surfaces may function to more evenly spread the frictional forces impinging thereon across the cutting elements, particularly for ***rotating tools such as disk sanders and CMP pad dressers***. ***The greater downward force applied by higher central portions of the tool may offset the higher rotational velocity at the periphery, thus reducing the mechanical stress experienced by cutting elements in that location***. As such, the slope may be continuous from a central point of the tool to a peripheral point, or the slope may be discontinuous, and thus be present on only a portion of the tool. Similarly, a given tool may have a single slope or multiple slopes. In certain aspects, the tool may slope in a direction from a central point to a peripheral point, or it may slope from a peripheral point to a central point.").
- Kinik298 at [0059] ("As such, in one aspect, a majority of the plurality of individual cutting elements may protrude to a predetermined height above the solidified organic material layer. Though any predetermined height that would be useful in an abrading or cutting tool would be considered to be within the presently claimed scope, in one specific aspect the ***predetermined height may produce a cutting depth of less than about 20 microns when used to abrade a workpiece***. In another specific aspect, the ***predetermined height may produce a cutting depth of from about 1 micron to about 20 microns when used to abrade a workpiece***. In yet another specific aspect, the ***predetermined height may produce a cutting depth of from about 10 micron to about 20 microns when used to abrade a workpiece***.").

[redacted]

- Liao at 372 ("Fig. 1 shows the time variation of the dressing rate for the conditioners having diamond separation (spacing) of 500μm and 700μm , respectively. It can be seen that the dressing rate for the diamond spacing of 700μm is higher than that of 500μm's. The penetration depths for these two specifications conditioner under 1kg downforce are given in Table 1. It is clear that a higher dressing rate for the conditioner of 700μm diamond separation is the result of larger penetration depth owing to less ***working diamonds***.")
- Liao at Table 1:

Spec.	Penetration depth (μ m)
700 G	12
700 S	7
500 G	5
500 S	5.7

Table 1 Penetration depth for various specification conditioners

- Liao at Table 2:

Spec.	No. of working. diamonds	Groove width(μ m)
700 G	59	96
700 S	55	98.6
700 UN	52	98.7

Table 2 Number of working diamonds *N* and groove width *w*

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[redacted]

- Sung479 at [0073] ("Variations in superabrasive particle size between different locations on the tool may also help to more evenly distribute the frictional forces impinging thereon. Larger superabrasive particles will most likely experience greater frictional force than would smaller particles. ***Additionally, in the case circumferentially rotating tools such as CMP pad dressers***, ***superabrasive particles located near the periphery will most likely experience greater frictional force than particles located more centrally due to the greater rotational velocity at the periphery***. ***In such a case, frictional forces may be distributed across the CMP pad*** by locating larger superabrasive particles more centrally to offset this increase. As a result, the frictional forces are more evenly spread across all superabrasive particles, thus reducing particle failure. As such, in one aspect superabrasive particles in a central location of the tool are larger in size than superabrasive particles in a peripheral location on the tool. 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***. The larger superabrasive particles extend deeper into the solidified braze layer, and are thus more firmly supported therein. Also, for CMP pad dressers, larger particles at the periphery may provide more slurry clearance than smaller particles. Additionally, although a variety of sizes are contemplated, in one aspect the plurality of superabrasive particle may be from about 30 microns to about 500 microns in size. In another aspect the plurality of superabrasive particles are from about 100

[redacted]

microns to about 200 microns in size. It is also contemplated that the plurality of superabrasive particles may be of substantially the same size.").

- Sung479 at [0006]-[0009] ("There are a number of problems in attempting to provide such a pad dresser. First, the superabrasive particles must be significantly smaller than those typically used in currently know dressing operations. Generally speaking, the superabrasive particles are so small that a traditional metal matrix is often unsuitable for holding and retaining them. Further, the smaller size of the superabrasive particles necessitates the precise leveling of particle tip height in order to uniformly dress the pad. Traditional CMP pad dressers can have particle tip height variations of more than 50 μm without compromising dressing performance. However, such a variation 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… 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***.").
- Kinik2008 at Table 1:

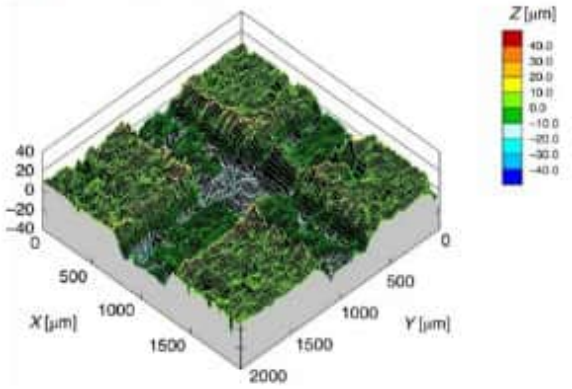
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Table 1 The contrasted features of ADD versus DiaGrid

	DiaGrid	*ADD*
Diamond levelling	> 50 μm	< 20 μm
Dressing rate	> 50 μm/hr	> 20 μm/hr
Working crystals	< 10%	> 90%
Brocken crystals	> 20%	< 1%
Diamond shape	Irregular	Symmetrical
Diamond angle	> 100°	< 90°
Dressing stress	Large (Tearing)	Low (Cutting)
Dressing temperature	High	Low
Acid proof	No	Yes
Pad life	Short	Long
Disk life	Short	Long
Asperity	Random	Uniform
Uniformity	Low	High

- Kinik2008 at Fig. 3:

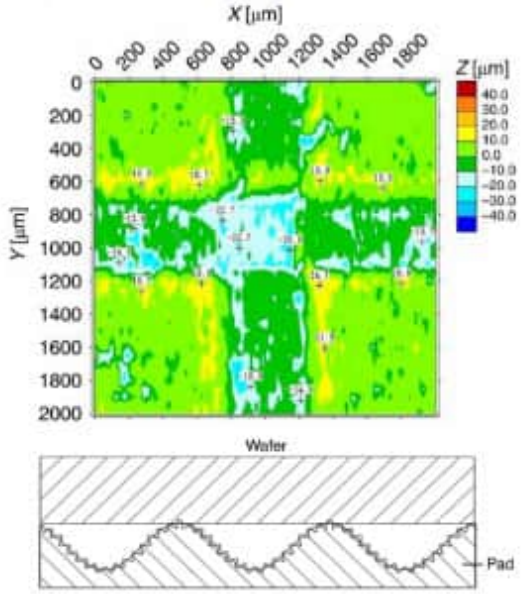
Figure 3 Each diamond grit on the pad conditioner can cut out a groove on the pad surface (see online version for colours)



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[redacted]

Figure 3 Each diamond grit on the pad conditioner can cut out a groove on the pad surface (see online version for colours) (continued)



- Yen at [0009] ("U.S. Pat. No. 6,769,975 discloses a method for forming a pad conditioner. The method involves forming a plurality of holes in a spacer, each of which has a cylindrical portion having a diameter smaller than the average particle diameter of the diamond abrasive grains, and a bowl-shaped upper portion enlarged in dimensions from the cylindrical portion to a top end of the spacer. After disposing the diamond abrasive grains in the holes, a bonding layer at an upper face of the spacer is formed so as to enclose and bond to the diamond abrasive grains, and the spacer is then removed to ***expose a portion of each of the diamond abrasive grains, that serves to cut a polishing pad***. Although the quality of the pad conditioner thus formed is improved, there is still a need for further improving the aforesaid height difference problem and ***increasing the number of the pointed corners 913 and/or the linear corners 914 disposed as the top ends of the diamond abrasive grains 4 of the pad conditioner***.")

[redacted]

- Lawing at [0003]-[0008] (“Particles with large depths of penetration into the polishing pad contribute to accelerated wear of the pad. ***Pad wear can be minimized by controlling or limiting the penetration depth of the abrasive particles into the polishing pad***. ***This can be achieved by physically limiting the effective dimensions of the abrasive particles by limiting the amount they protrude from the surface*** of the[.] Another method of controlling the penetration depth would be to tightly control the size distribution of the abrasive particles. A narrow size distribution of particles would result in abrasive point contacts of substantially the same height, such that the ***penetration depth of the abrasive particles into the polishing pad would be substantially uniform***. Particle size control is achieved through a costly process of incremental sieving to refine the crystal size variation down to a tolerable range. Penetration depth plays a significant role in the performance of a pad conditioner. Conditioners exhibiting a large mean penetration depth are generally very aggressive, result in rapid thinning of the polishing pad. These types of conditioners can be useful in a situation were it is desirable to perform very aggressive conditioning for a small amount of time, i.e. ex situ applications where the polishing pad is conditioned between wafers, and conditioning time reduces wafer throughput. On the other hand, since the wafer is only contacting the upper surface of the polishing pad, the surface morphology of interest is generated mostly by particles interacting at small penetration depths. Combining particles of various controllable penetration depths to exploit their respective advantages while minimizing the disadvantages has not been feasible with conventional pad conditioners. PCT International

[redacted]

Publication Number WO 99/41039 by Applied Materials, Inc. discloses an end effector for pad conditioning that is formed with the crystals embedded in a matrix material. This end effector allows for the use of smaller crystals. However the only mechanism to control the abrasive surface depth of the end effector is through particle size uniformity. The use of a mixture of particle sizes in this end effector would necessarily result in an uneven abrasive surface. The uneven surface would necessarily apply uneven force to the polishing pad during the conditioning process. As a result of the uneven applied force, the pad conditioner would fail to adequately condition the polishing pad in some regions, while simultaneously over-conditioning and substantially thinning the polishing pad in other regions. There remains a need in the art to optimize and tailor the surface characteristics of various polishing pads. ***The relative height of abrasive particles has a major influence on their penetration into the pad,*** and therefore the aggressiveness of the conditioning action. The height of the diamond particles also has a profound affect on the surface texture of the polishing pad and therefore, polish performance. ***Precise control of the relative diamond height would provide precise control over the aggressiveness of the conditioning***. Additionally, the long term stability of the conditioner is determined by the uniformity of the penetration depth distribution. Conditioners with an initially large distribution of penetration depths will wear unevenly over time, and the distribution of penetration depths, and correspondingly the applied pressure distribution as well as the consistency of the conditioning action, will become more broad as the conditioner becomes worn. With precise control of the abrasive

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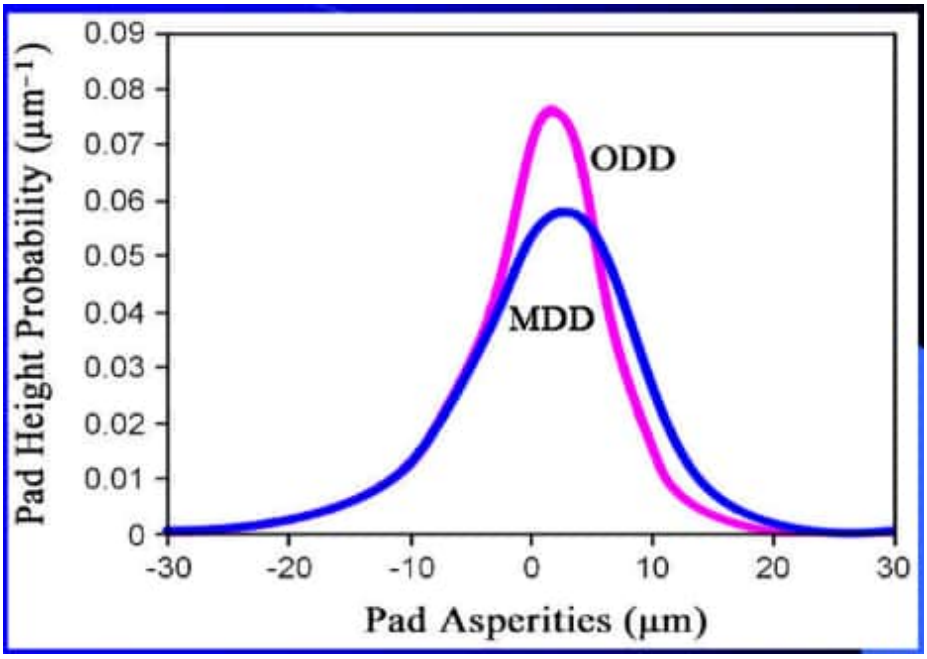
surface depth, a pad conditioner could be optimized and tailored for use with various polishing pads. The relative height of abrasive particles has a major influence on their penetration into the pad, and therefore the aggressiveness of the conditioning action. Precise control of the relative diamond height is required to control the aggressiveness of the conditioning as well as the stability of the pad conditioner. Additionally, the ability to precisely control relative abrasive particle height would enable the manufacture of ***"self-limiting" pad conditioners in which the penetration depth of the abrasive particles into the polishing pad materials is limited by the precisely controlled protrusion of the abrasive particles from the matrix in which they are imbedded***, rather than the tedious control of the particle size. However, conventional fabrication techniques do not provide for making a pad conditioner with a uniform particle height.")

- Tian at [0032]-[0033] ("FIG. 2 is a sectional view of one embodiment of a conditioning mechanism 134. The conditioning mechanism 134 generally includes a conditioning head assembly 202 coupled to a support member 204 by an arm 206. The support member 204 is disposed through the base 140 of the polisher 108. Bearings 212 are provided between the base 140 and the support member 204 to facilitate rotation of the support member 204. An actuator 210 is coupled between the base 140 and the support member 204 to control the rotational orientation of the support member 204. The actuator 210, such as a pneumatic cylinder, servo motor, motorized ball screw, harmonic drive, or other motion control device that is adapted to control the rotational orientation of the support member 204, allows the arm 206 extending from the support member 204

[redacted]

to be rotated about the support member 204, thus laterally positioning the conditioning head assembly 202 relative to the polishing station 126. ***A conditioning element 208 is coupled to the bottom of the conditioning head assembly 202, for example, to a backing plate 250, and may be selectively pressed against the platen 130 while rotating to condition the polishing material 128***. The conditioning element 208—and the backing plate 250—are typically round, or disk-shaped, to facilitate smooth rotation of the conditioning element 208 and enhance control of the process.")

- CMPUG2009 at Slide 17:



- AT2006 at AT000138 ("Experimental data is presented on oxide removal rates and non-uniformity of thermal oxide wafers polished using an ***Applied Materials Mirra Mesa® polishing tool***. Although ***pad cut rates*** were negligible, ***oxide removal rates*** were comparable with the reference Best Known Method (BKM) over the lifetime of the disk. Microscopy of the disks after use confirms that a

[redacted]

high percentage of the diamond grains exhibit wear from contact with the polishing pad, confirming the effectiveness of this type of disk and the overall flatness of the diamond plane. A white light chromatic aberration technique was used to confirm the overall flatness of the conditioning plane.")

- Kinik869 at [0056] ("Various configurations or arrangements are contemplated for minimizing the mechanical stress impinging on the superabrasive particles held in the abrading tool. One potentially useful parameter may include the relative heights that the superabrasive particles protrude above the organic material layer. A superabrasive particle that protrudes to a significantly greater height than other superabrasive particles will experience a greater proportion of the impinging mechanical forces and thus is more prone to pull out of the solidified organic material layer. ***Thus an even height distribution of superabrasive particles may function to more effectively preserve the integrity of the abrading tool as compared to abrading tools lacking such an even height distribution***. As such, in one aspect, a majority of the plurality of superabrasive particles may protrude to a predetermined height above the solidified organic material layer. ***Though any predetermined height that would be useful in an abrading tool would be considered to be within the presently claimed scope, in one specific aspect the predetermined height may produce a cutting depth of less than about 20 microns when used to abrade a work piece. In another specific aspect, the predetermined height may produce a cutting depth of from about 1 micron to about 20 microns when used to abrade a work piece. In yet another specific aspect, the predetermined height may produce a cutting depth***

[redacted]

of from about 10 micron to about 20 microns when used to abrade a work piece. It should also be noted that the variation in the leveling of superabrasive particles to a predetermined height that is required to minimize mechanical stress may be somewhat dependent on superabrasive particle spacing. In other words, the farther superabrasive particles are separated, the more the impinging forces will affect each superabrasive particle. As such, patterns with increased spacing between the superabrasive particles may benefit from a smaller variation from predetermined height.")

- Kinik869 at [0058]-[0059] ("In addition to planar profiles, in another aspect of the present invention the designated profile has a slope. ***Tools having sloping surfaces may function to more evenly spread the frictional forces impinging thereon across the superabrasive particles, particularly for rotating tools such as disk sanders and CMP pad dressers***. The greater downward force applied by higher central portions of the tool may offset the higher rotational velocity at the periphery, thus reducing the mechanical stress experienced by superabrasive particles in that location. As such, the slope may be continuous from a central point of the tool to a peripheral point, or the slope may be discontinuous, and thus be present on only a portion of the tool. Similarly, a given tool may have a single slope or multiple slopes. In certain aspects, the tool may slope in a direction from a central point to a peripheral point, or it may slope from a peripheral point to a central point. Various slopes are contemplated that may provide a benefit to solidified organic material layer tools. It is not intended that the claims of the present invention be limited as to specific slopes, as a variety of slopes in

[redacted]

numerous different tools are possible. In one aspect, however, a CMP pad dresser may benefit from an average slope of 1/1000 from the center to the periphery. As a variation on tools having a slope, in certain aspects the designated profile may have a curved shape. One specific example of a curved shape is a dome shape tool. Such curved profiles function in a similar manner to the sloped surfaces. Tools 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 tool.")

- Kinik869 at [0004] ("One problem that arises with regard to maintaining the pad surface, however, is an accumulation of polishing debris coming from the work piece, the abrasive slurry, and the pad dresser. This accumulation causes a "glazing" or hardening of the top of the pad, mats the fibers down, and thus makes the pad surface less able to hold the abrasive particles of the slurry. These effects significantly decrease the pad's overall polishing performance. Further, with many pads, the pores used to hold the slurry, become clogged, and the overall asperity of the pad's polishing surface becomes depressed and matted. ***A CMP pad dresser can be used to revive the pad surface by "combing" or "cutting" it. This process is known as "dressing" or "conditioning" the CMP pad***. Many types of devices and processes have been used for this purpose. One such device is a disk with a plurality of superhard crystalline particles such as diamond particles attached to a metal-matrix surface.")
- *See also* EX862-12 (limitations 1(e) and 1(f)); EX802-13 (claims 6, 7, 16, 17)

[redacted]

6. CMP Pad Dressers Having A Desired Number of Working Superabrasive Particles Were Well-Known.

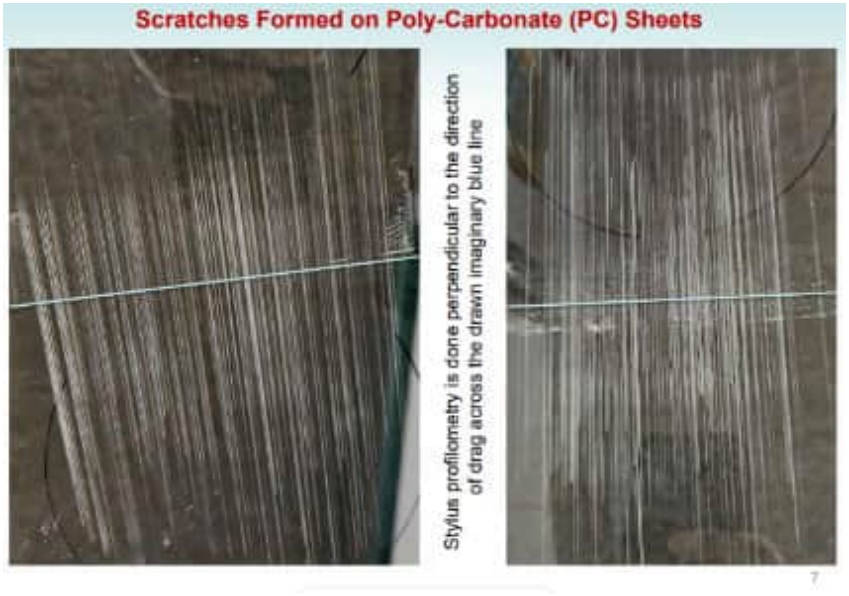
Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 and '802 Patents, it was well known that a CMP pad dresser includes working particles or tips that cut asperities into the CMP pad as the dresser is rotated. It was also well known that the number of working particles or the number of tips that cut into the CMP pad may be controlled. For example, the number of tips that cut asperities into the CMP pad dresser was well understood to be at least 100, at least 50, or at least 25. Also, the number of working particles was well understood to be at least 100, at least 1000, about 1000 to about 6000, about 2000 to about 5000, at least about 1000. Moreover, it was well known that the CMP pad dresser may include at least about 1000 working particles protruding from the rigid support substrate to distances within about 30 microns of one another.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, claim 2 of Exhibits 862-1 through 862-7 and 862-11 through 862-12, claims 3 and 4 of Exhibits 862-1 through 862-7, 862-9, and 862-11 through 862-12; and claim 8 of Exhibits 802-1 through 802-7, 802-10, and 802-12 through 802-13, claims 9 and 12 of Exhibits 802-1 through 802-7, 802-10, 802-12 through 802-13, claims 10 and 11 of Exhibits 802-1 through 802-3, 802-7, 802-10, 802-12 through 802-13 provide numerous examples of references (collectively, the "Working Particles References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Liao, Kinik2008, Yen, Tian, CMPUG2009, AT2006, Kinik869, and Kinik298—that teach CMP pad dressers with a different number of working particles or a different number of tips that cut asperities into CMP pads, each of which are incorporated herein by reference. The following exemplary citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in Exhibits 862-1 through 862-7 and

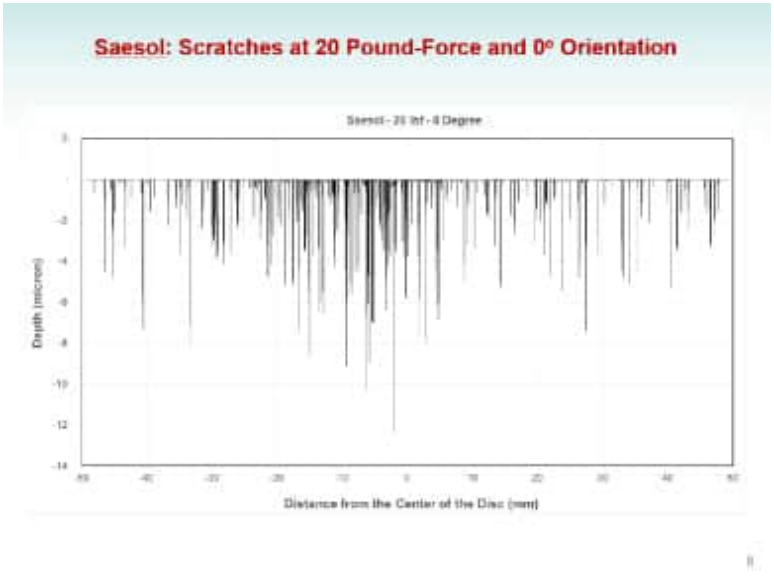
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862-211 through 862-12, claims 3 and 4 of Exhibits 862-1 through 862-7 , 862-9, and 862-11 through 862-12; and claim 8 of Exhibits 802-1 through 802-7, 802-10, and 802-12 through 802-13, claims 9 and 12 of Exhibits 802-1 through 802-7, 802-10, 802-12 through 802-13, claims 10 and 11 of Exhibits 802-1 through 802-3, 802-7, 802-10, 802-12 through 802-13 in demonstrating that this concept was well-known.

- Saesol PA—Saesol Analysis at 7

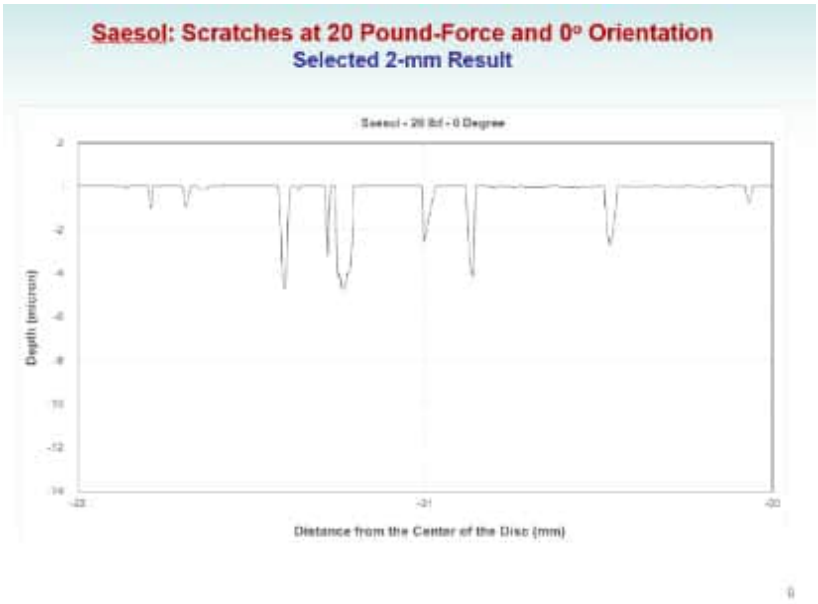


- Saesol PA—Saesol Analysis at 8

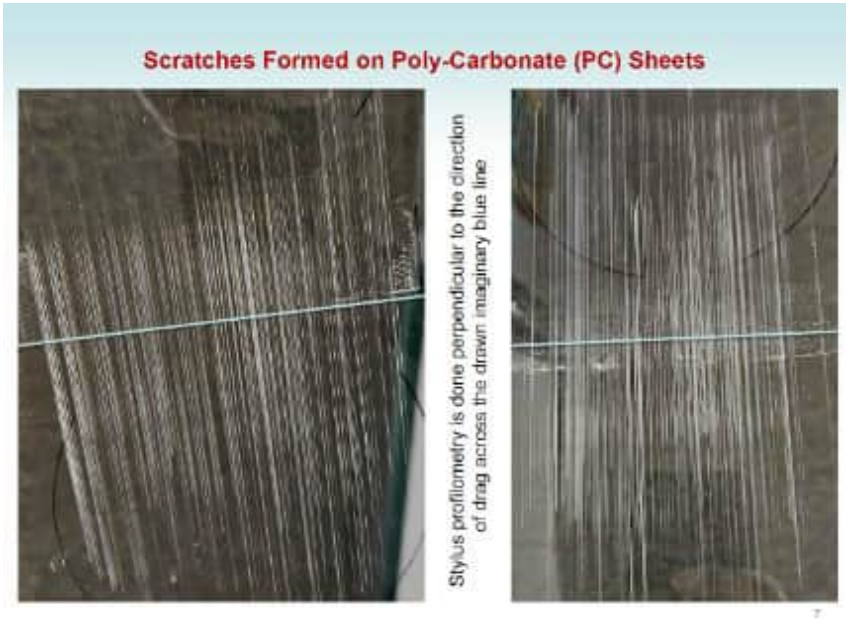


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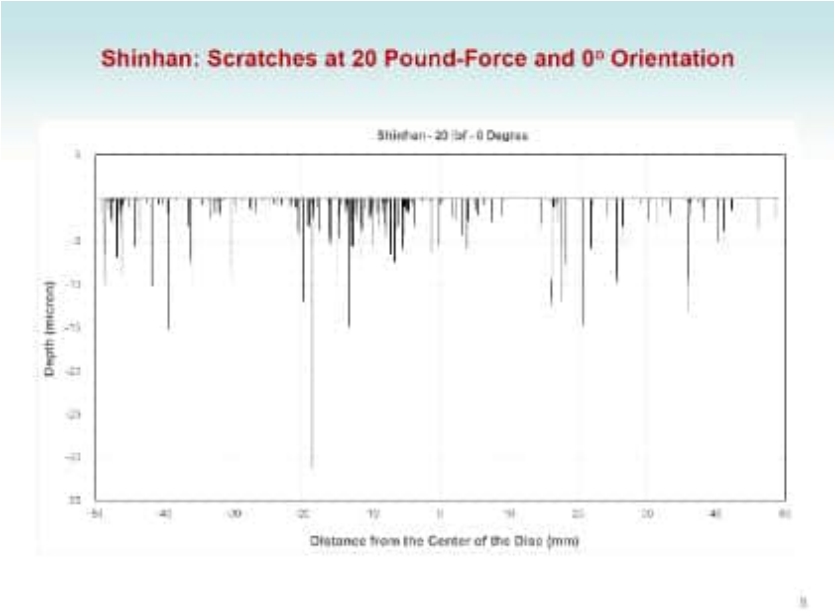
- Saesol PA—Saesol Analysis at 9



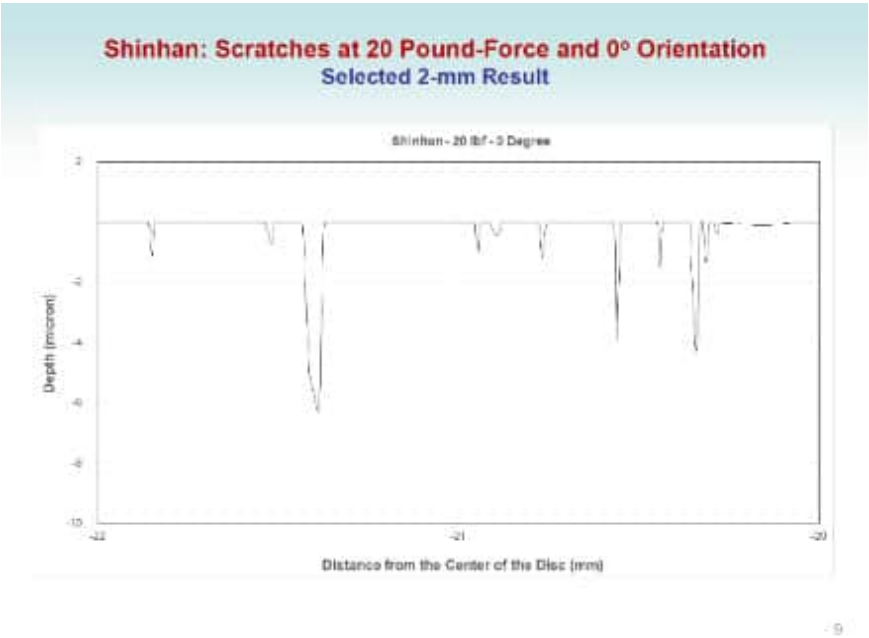
- Shinhan PA—Shinhan Analysis at 7



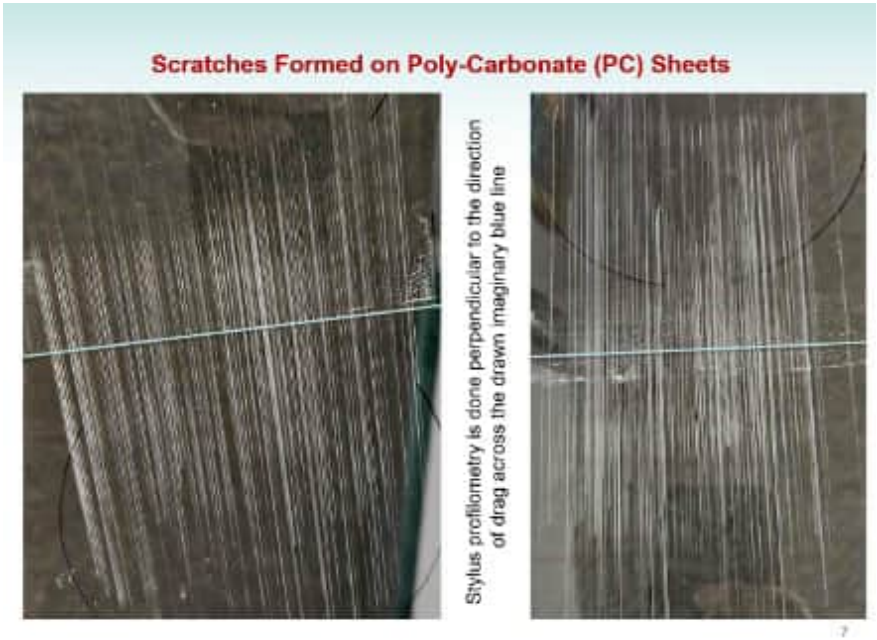
- Shinhan PA—Shinhan Analysis at 8



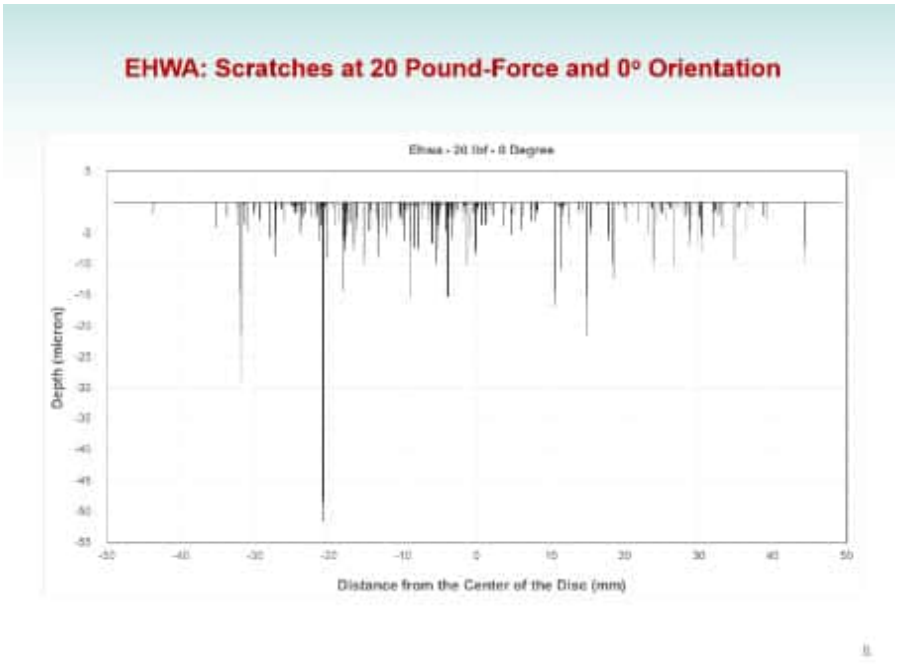
- Shinhan PA—Shinhan Analysis at 9



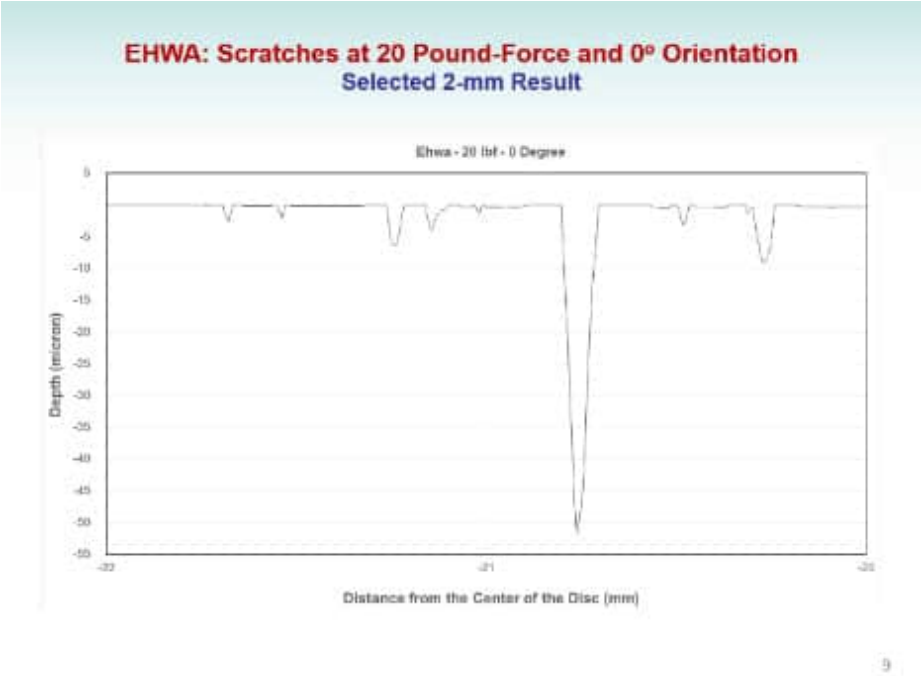
- EHWA PA—EHWA Analysis at 7



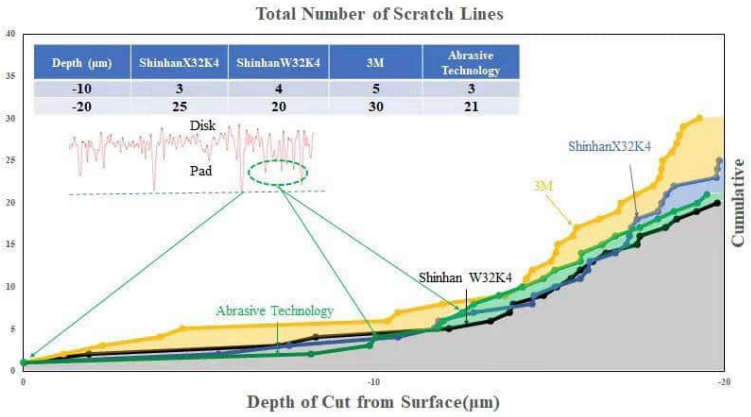
- EHWA PA—EHWA Analysis at 8



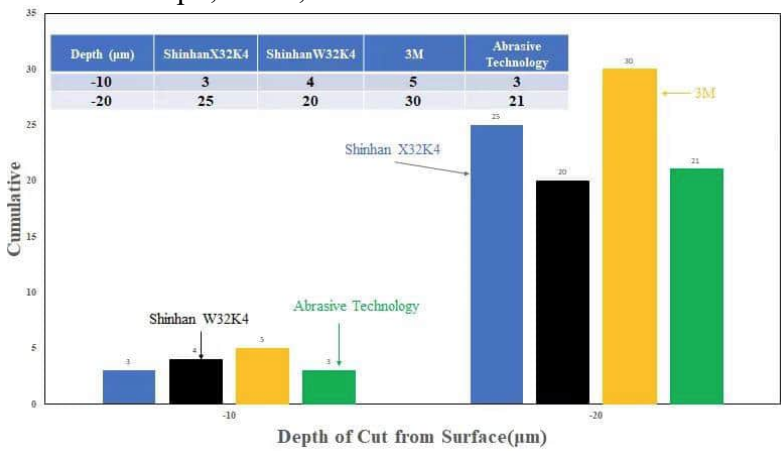
- EHWA PA—EHWA Analysis at 9



- 3M PA—Compl., D.I. 1, Ex. 9 at 10

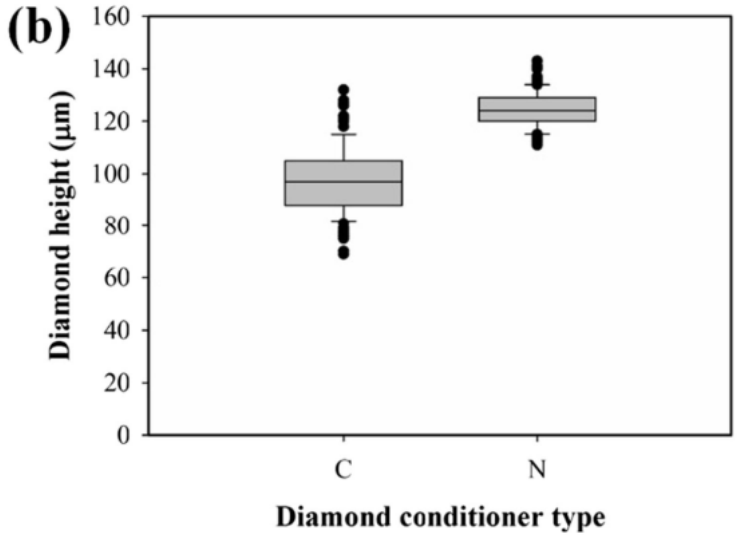


- 3M PA—Compl., D.I. 1, Ex. 9 at 11



[redacted]

- 3M PA and ATI PA—SAMSUNG_CMS_006552



- ATI PA—AT000280 at 30



- ATI PA—AT000280 at 31

[redacted]

- ATLPA—AT000280 at 32

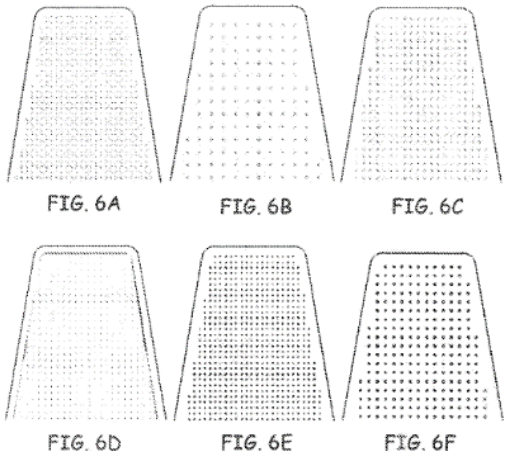


- Smith at 15:28-16 ("Referring again to FIGS. 6, the sizes (base dimensions) of the protrusions, densities of the protrusions, and resulting protrusions per segment illustrated in the depictions above are as follows: protrusions with base dimensions of 85 μm, ***density of 5 protrusions per square millimeter, and 1460 protrusions per segment*** (FIG. 6A); protrusions of 125 μm base dimension, ***1 protrusion per***

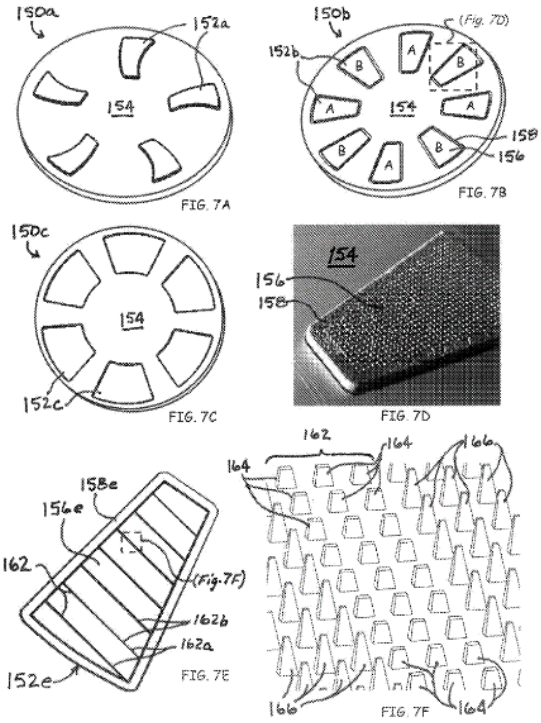
[redacted]

square millimeter, and 290 protrusions per segment (FIG. 6B); interspersed protrusions of 125 μm and 85 μm base dimensions***, 3 protrusions per square millimeter, with 495 125-μm base dimension protrusions and 375 85-μm base dimension protrusions per segment*** (FIG. 6C); protrusions of 65 μm base dimension with a lead in edge, ***3 protrusion per square millimeter absent the lead in edge, and 880 protrusions per segment*** (FIG. 6D); 125 μm base dimension protrusions, ***5 protrusions per square millimeter, and 1460 protrusions per segment*** (FIG. 6E); and 200 μm base dimension protrusions, ***2 protrusions per square millimeter, and 585 protrusions per segment*** (FIG. 6F).")

- Smith at FIG. 6:



- Smith at FIG. 7:



- Ishizuka at 8:2-31 ("The contrast between ADD and DiaGrid® pad conditioner is dramatic in the global view of optical microscopy, and in the detailed layout of the array as well as the profiling of the ***cutting tips*** as revealed below (Fig. 11). The performance of pad conditioners can be measured by two most critical parameters, the longevity of the pad conditioner and the pad; and the effectiveness of the pad dressing. The longevity can be improved ***by leveling of cutting tips that increases the number of working crystals on the pad conditioner.*** The effectiveness of the pad dressing may be improved by the sharpness of the cutting tips, the sharper, the faster to create the density of pad asperity as required for polishing. Due to the even loading of the pad and the uniformity of asperities, wafer polishing can be much more uniform. Moreover, because the polishing can only be achieved by the contact between wafer and pad, ADD with more polishing points generated on the pad may polish at a higher removal rate even if the individual polishing rate is low at each

[redacted]

contact point. The low-pressure contact at each polishing point will also assure the uniformity of the polish performance (Fig. 12). Due to the seriated feature of PCD surfaces and edges, ADD can cut pads cleaner with less tearing. Moreover, the pad dressed has a higher specific surface area than that dressed by a conventional pad conditioner. The more textured pad surface can trap more abrasive particles on asperities. Consequently, a higher polishing rate of wafer or a reduced usage of slurry may be achieved.")

- Liao at Table 2:

Spec.	No. of working. diamonds	Groove width(μ m)
700 G	59	96
700 S	55	98.6
700 UN	52	98.7

Table 2 Number of working diamonds *N* and groove width *w*

- Kinik2008 at Table 1:

Table 1 The contrasted features of ADD versus DiaGrid

	DiaGrid	*ADD*
Diamond levelling	> 50 μm	< 20 μm
Dressing rate	> 50 μm/hr	> 20 μm/hr
Working crystals	< 10%	> 90%
Brocken crystals	> 20%	< 1%
Diamond shape	Irregular	Symmetrical
Diamond angle	> 100°	< 90°
Dressing stress	Large (Tearing)	Low (Cutting)
Dressing temperature	High	Low
Acid proof	No	Yes
Pad life	Short	Long
Disk life	Short	Long
Asperity	Random	Uniform
Uniformity	Low	High

- Kinik2008 at p. 336 ("A revolutionary new design of diamond pad conditioner is now available, this ***Advanced Diamond Disk (ADD) has identical cutting***

[redacted]

pyramids with tips extended to the same height. Consequently, ***ADD can dress pads to achieve unprecedented uniformity in asperities***. The furrows are more evenly spaced, the grooves have similar shapes and there are no killer asperities. All these unique features are needed to achieve uniform polishing of delicate wafers of the future (Figure 9). The flatness of ADD and the tip height variation of the cutting pyramids can be mapped based on optical focal depths (e.g. instrument provided by FRT) and pressure sensitive detectors (e.g. instrument provided by Tekscan). It is desirable to have tips located along a slight convex plane so that ***the number of cutting tips engaged in dressing the pad is maximised*** (Figure 10).")

- Yen at [0045]-[0051] ("A die **2** made by wire cutting techniques was provided to imprint a plastic substrate 11 so as to form a plurality of pyramidal recesses **12** therein (FIGS. 3-5). The die **2** was made from a stainless steel plate **21** that was formed with a plurality of right pyramids **22** protruding from a die surface **211** of the stainless steel plate **21** having a diameter of 110 mm and a thickness of 30 mm. The right pyramids **22** were distributed over a region with a diameter of 100 mm on the die surface **211**. The distance between tip ends **221** of each two adjacent ones of the right pyramids **22** was 700 μm. The tip end **221** of each of the right pyramids **22** defined an angle of about 90° and a height of 350 μm relative to the die surface **211**. The plastic substrate **11** was made from polypropylene, and had a diameter of 110 mm and a thickness of 0.4 mm. A pressure of 10 MPa was applied on the die **2** to imprint the plastic substrate **11** so as to ***form about 15785 pyramidal recesses 12***, each of which defined an angle of 90°, a depth **122** of 225 μm relative to a surface **13** of the plastic substrate **11**, and a width 123 of 450 μm. The distance

between the sharp closed ends **121** of each two adjacent ones of the pyramidal recesses **12** was 700 μm. It is noted that formation of the pyramidal recesses **12** can also be conducted through injection molding or die casting, or through electronic discharge machining, ultrasonic machining, micro-milling, laser machining, electron beam machining, and ion beam machining techniques, which can dispense with the die **2**. A stainless steel screen **32** having a thickness of 50 μm and formed with circular holes **321** of 0.2 mm in diameter was disposed on the plastic substrate **11**. An adhesive **31** was formed by mixing a water-based acrylic pressure sensitive adhesive (SP-7533, produced by 3M CO.) and deionized water at a weight ratio of 1:1. The adhesive **31** was applied to the stainless steel screen **32**, and was forced into the pyramidal recesses **12** using a scraper **34**. The plastic substrate **11** was then placed in a hot recirculating oven under a temperature of 50° C. for 15 min. The height **311** of the adhesive **31** in the recess **12** relative to the sharp closed end **121** of the recess **12** was about 50 μm (FIG. 8). ***A plurality of the diamond abrasive grains 4*** having a cuboctahedron shape with a particle diameter ranging from 40 mesh to 45 mesh (SDB1100, produced by ELEMENTSIX) ***were distributed over the plastic substrate 11***, and ***were moved into the recesses 12 using an acrylic brush so as to be bonded to the adhesive 31 in the recesses 12.*** It is noted that moving of the diamond abrasive grains **4** into the recesses **12** can also be conducted using an oscillator. Excess diamond abrasive grains **4** were removed from the plastic substrate **11** using the brush or using the oscillator. A pressing plate **35** of silicon was then disposed on the diamond abrasive grains **4** on the plastic substrate **11**, and a pressure of 0.2 MPa was subsequently applied on the pressing plate **35** to

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[redacted]

force the diamond abrasive grains 4 into the recesses 12 so as to ensure that the sharp corners 913, 914 of the diamond abrasive grains 4 are fully received in the sharp closed ends 121 of the recesses 12 (FIG. 7).")

- Yen at [0071] ("Since the maximum height difference is relatively small for the pad conditioner **100** of this invention, ***more diamond abrasive grains 4 can serve as the working diamonds*** as compared to the conventional pad conditioner, which improves the cutting rate, removal stability, and service life of the polishing pad processed by the pad conditioner **100**.")
- Tian at [0040] ("Although the conditioning element 208 may be any shape, it is practical and convenient to have a circular, or disk-shaped conditioning element. In one embodiment suitable for conditioning ECMP pads, such as ECMP pads used to process 200 and 300 mm substrates, the ***conditioning element 208 has a diameter between about 100 and about 110 mm. In one embodiment, the conditioning element 208 has a diameter of about 108 mm.*** The conditioning element 208 is generally stiff or rigid enough to minimize flexing under processing conditions. The rigidity of the conditioning element 208 may be obtained by material selection and/or the thickness of the conditioning element 208. For example, the conditioning element 208 may have a thickness of between about 6 and about 7 mm.")
- Tian at [0047] ("***To maintain satisfactory conditioning performance and to reduce the likelihood of damaging the conductive surface of the ECMP pad, the diamond particles 350 have a controlled distribution and spacing***. In one embodiment, the diamond particles 350 have a distribution of between about 251

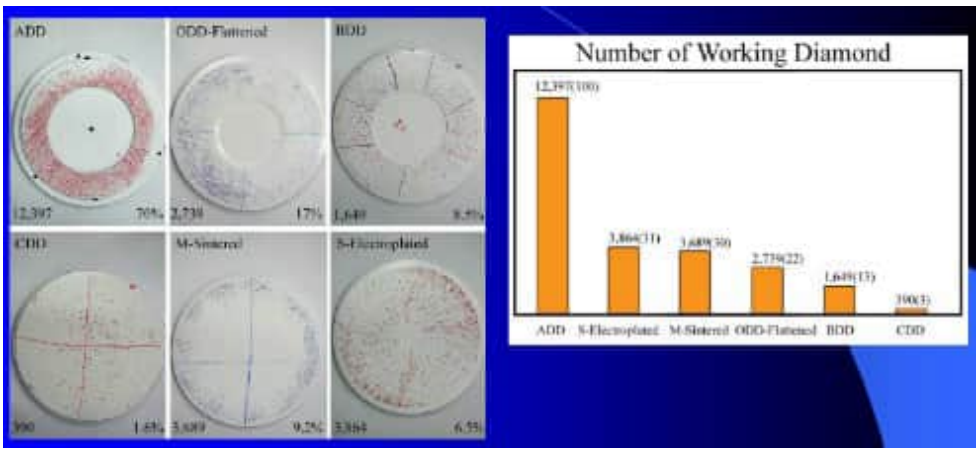
and 261 particles per square cm. ***The diamond particles 350 may have a diamond to diamond distance of between about 300 µm and about 600 µm. In another embodiment, the diamond particles 350 are spaced greater than about 400 µm apart***. The distribution of the diamond particles 350 is also controlled during fabrication to be substantially uniform.")

- Tian at [0041]-[0043] ("***The conditioning surface 300 may cover the entire face 301 of the conditioning element 208. Alternatively, the conditioning surface 300 may cover only a portion of the face 301***. In the embodiment depicted in FIGS. 3A and B, the conditioning surface 300 is formed on an annular portion 302 that protrudes from the body 310. The annular portion 302 is generally concentric, or centered on the body 310. The inner and outer diameters of the annular portion 302 (e.g., the width of the annular portion 302) may be selected to control the surface area of the conditioning surface 300. In one embodiment, the width of the annular portion is between about 24 and about 30 mm. A recessed area 304 is disposed within center of the annular portion 302 to ensure that ***only the conditioning surface 300 contacts the material to be conditioned during processing***. Optionally, one or more of an outer edge 306 and an inner edge 308 of the annular portion 302 may be relieved, such as by a radius, bevel, chamfer, and the like. The relieved edges reduce the likelihood that any sharp burrs or edges may scratch or gouge the material to be conditioned. ***The conditioning surface 300 generally comprises particles 350, also referred to as grit, of an extremely hard material, such as diamond***, that is securely embedded in or bonded to the body 310. The particles 350 may be embedded or bonded to the body 310 by suitable methods. To

[redacted]

reduce the likelihood of damaging the material being conditioned, ***the particles 350 may be arranged on the conditioning surface 300*** and may be excluded from any relieved edges 306, 308 and recessed areas 304 of the conditioning element 208.")

- CMPUG2009 at Slide 15:



- AT2006 at AT000141 ("1. A ceramic substrate and ceramic matrix were used to produce an ultra-flat conditioning disk (4x improvement over a conventional disk). 2. Post use optical inspection confirmed that ***a large percentage (> 90%) of diamonds showed evidence of some wear confirming the effectiveness of conditioning***. 3. Wafer removal rate was demonstrated as comparable to an Applied Materials Mirra BKM process. 4. The non-metallic conditioner is inert to corrosive slurries such as ceria and low pH ferric nitrate.")
- Kinik869 at [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. In one aspect, for example, a method of improving retention of superabrasive particles held in a solidified organic material layer of an abrading tool, a portion of each of said superabrasive particles protruding out of the solidified organic material layer is provided. Such a

method may include securing the plurality of superabrasive particles in the solidified organic material layer such that the organic material layer wicks up the protruding portions of the superabrasive particles. In addition to the wicking of the organic material layer around the superabrasive particles, various additional parameters may be utilized to improve retention. For example, in another aspect the plurality of superabrasive particles may be secured in an arrangement that minimizes mechanical stress impinging on protruding portions of any individual superabrasive particle when used to abrade a work piece***. As an example, the arrangement of the plurality of superabrasive particles may be configured to uniformly distribute drag forces across substantially each superabrasive particle***.")

- Kinik869 at [0094] ("***80/90 mesh diamond particles (MBG-660, Diamond Innovations) are arranged with a template on a 100 mm diameter, 10 mm thick flat base plate. The diamond particles form a grid pattern with an inter-diamond pitch of about 500 microns***. The plate is placed at the bottom of a steel mold and covered with a polyimide resin powder. Subsequently, the entire assembly is pressed to 50 MPa pressure and 350° C. for 10 minutes. The polyimide consolidated plate is 7 mm thick with nickel coated diamond particles forming a grid on one side. A conventional grinding wheel with silicon carbide grit is used to grind the surface to expose the diamond particles to about 60 microns. The final product is a pad conditioner with uniformly exposed diamonds.")
- *See also* EX862-12 (claims 2-4); EX802-13 (claims 8-12)

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[redacted]

7. CMP Pad Dressers Having Superabrasive Particles Located At A Peripheral Location Of The Pad Dresser And Arranged In A Uniform Predetermined Pattern Were Well-Known.

Under at least the apparent construction based on Plaintiff's Infringement Contentions for the '862 and '802 Patents, CMP pad dressers having superabrasive particles located at a peripheral location and with predetermined patterns (such as a uniform pattern) were well-known in the art long before the respective priority dates of the '862 and '802 Patents. For example, it was well known that substantially all of the asperities are cut in the CMP pad by particles located at a peripheral location of a CMP pad dresser, such as a peripheral location extending from the outer edge to the center for up to about 90%, 50%, or 33% of the dresser radius. It was also well known that the superabrasive particles can be arranged uniformly the peripheral location. Moreover, it was well-known to arrange the superabrasive particles evenly with a spacing of about 100 to about 800 microns.

For example, under at least the apparent construction based on Plaintiff's Infringement Contentions, claim 5 of Exhibits 862-1 through 862-8 and 862-11 through 862-12, claim 6 of Exhibits 862-1 through 862-7, 862-11 through 862-12, claim 7 of Exhibits 862-4 through 862-7, 862-11 through 862-12, claim 8 of Exhibits 862-4 through 862-6 and 862-12, claims 9 and 10 of Exhibits 862-1 through 862-8 and 862-11 through 862-12; and claim 20 of Exhibits 802-1 through 802-2, 802-5 through 802-13, and claim 21 of Exhibits 802-1 through 802-2, 802-5 through 802-10, and 802-12 through 802-13 provide numerous examples of references (collectively, the "Peripheral Location References")—including Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Kinik2008, Yen, Lawing, Tian, and CMPUG2009, CMPUG2005—that teach CMP pad dressers having superabrasive particles located at a peripheral location and with a uniform pattern or even distribution with spacing of from about 100 to about 800 microns, each of which are incorporated herein by reference. The following exemplary

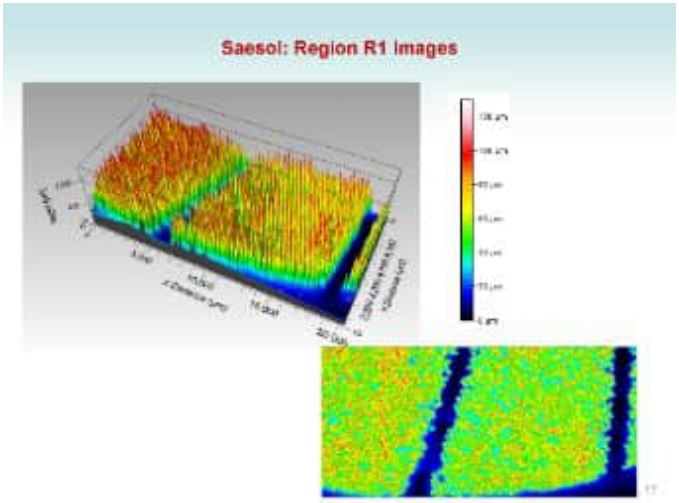
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citations are provided below for illustrative purposes and Defendants expressly rely on all of the citations provided in claim 5 of Exhibits 862-1 through 862-8 and 862-11 through 862-12, claim 6 of Exhibits 862-1 through 862-7, 862-11 through 862-12, claim 7 of Exhibits 862-4 through 862-7, 862-11 through 862-12, claim 8 of Exhibits 862-4 through 862-6 and 862-12, claims 9 and 10 of Exhibits 862-1 through 862-8 and 862-11 through 862-12; and claim 20 of Exhibits 802-1 through 802-2, 802-5 through 802-13, and claim 21 of Exhibits 802-1 through 802-2, 802-5 through 802-10, and 802-12 through 802-13 in demonstrating that this concept was well-known.

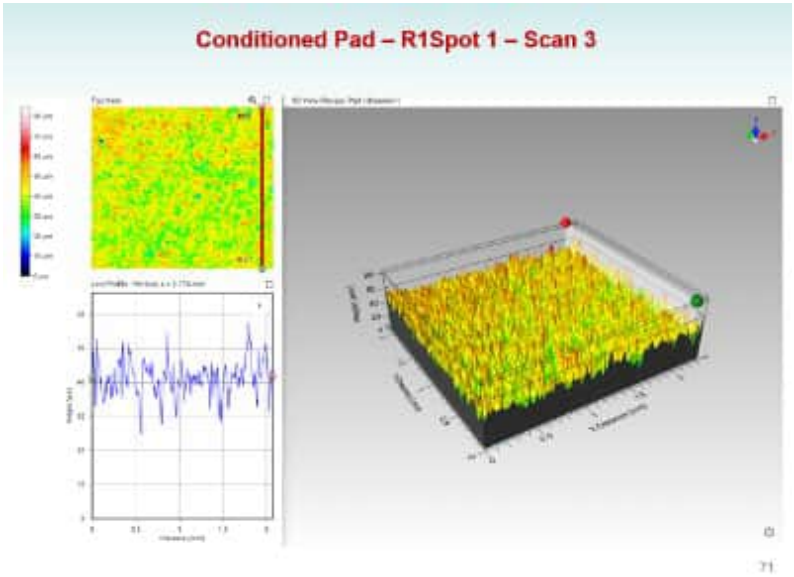
- Saesol PA—Saesol Analysis at 3



- Saesol PA—Saesol Analysis at 17



- Saesol PA—Saesol Analysis at 71

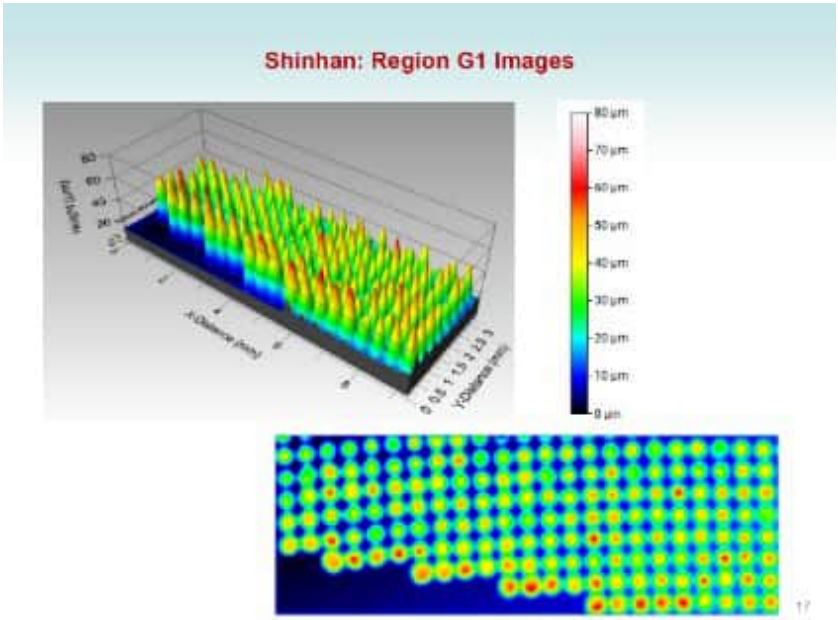


- Shinhan PA—Shinhan Analysis at 3

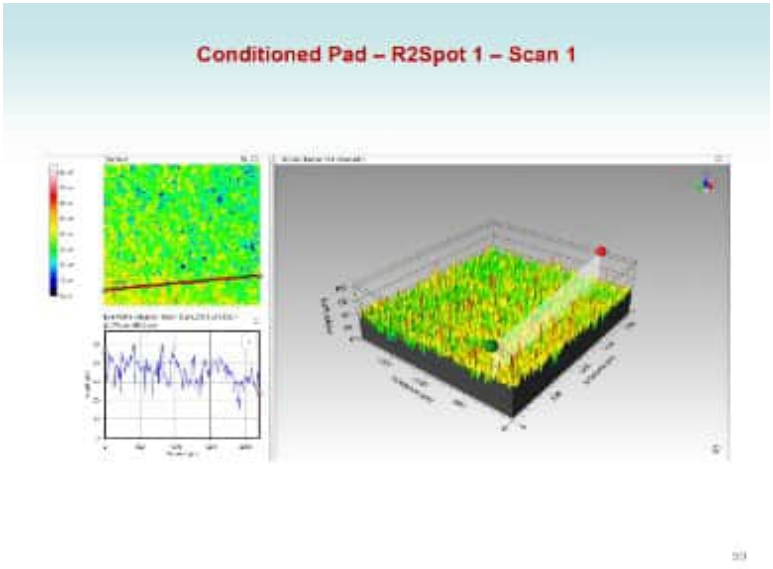


- Shinhan PA—Shinhan Analysis at 17

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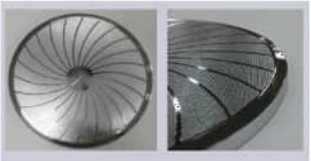
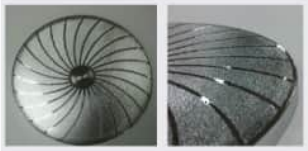
- Shinhan PA—Shinhan Analysis at 59



- Shinhan PA—SAMSUNG_CMS_006358 at 20

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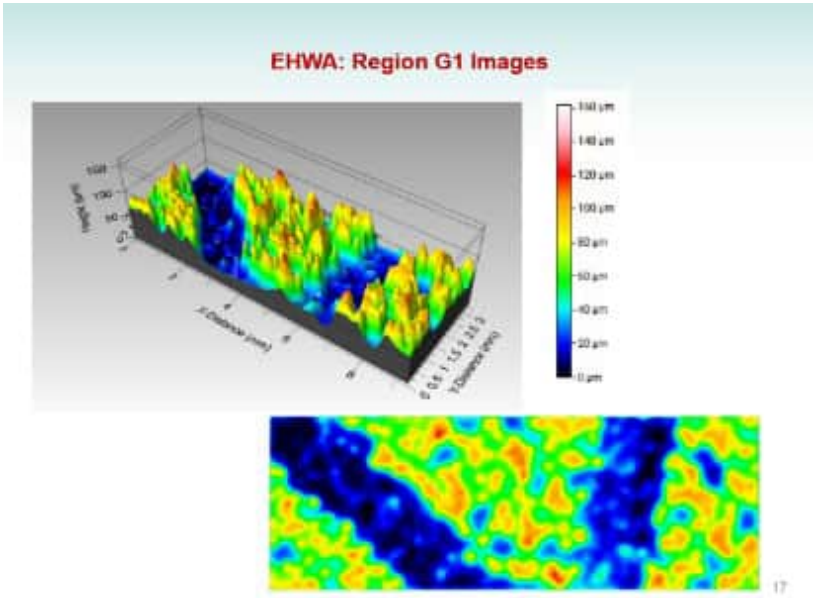
◆ 신한 Disk Type

제품 Type	Image	세부 설명
ARIX		신한 disk의 일반적인 타입으로써 disk의 성능을 조절하기 위해 diamond의 배열을 원하는 데로 배치할 수 있음.
ARIX-Wing		일반 ARIX제품의 경사진 edge 부분에 diamond를 추가적으로 배열함으로써 disk 외관 부분에 위치한 working dia.를 보조하여 disk 수명 개선에 효과가 있음.
ARIX-R		Ring type인 R 제품은, working dia.인 외곽 부분에 diamond를 배열함으로써 disk와 Pad의 접촉 면적을 줄여 효과적인 conditioning을 할 수 있도록 함. 수명 개선 및 성능 향상에 효과가 있음.

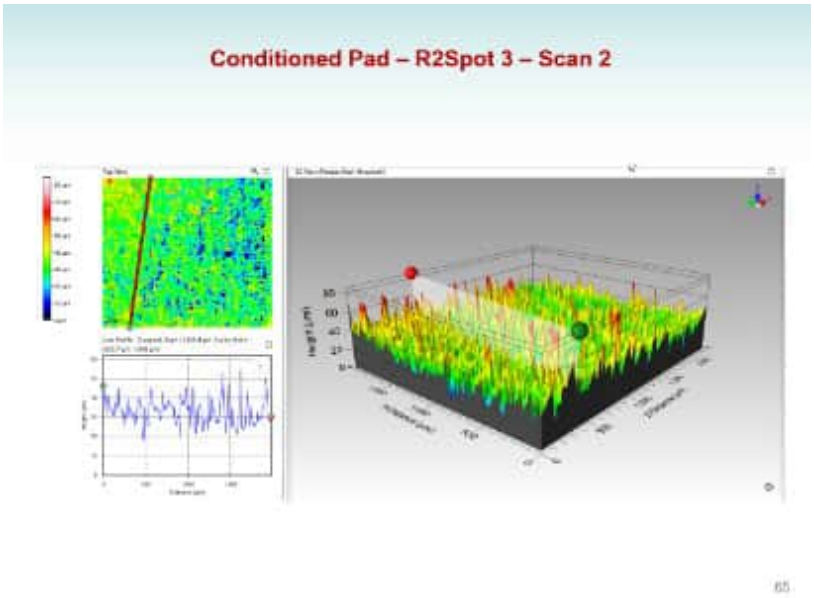
- EHWA PA—EHWA Analysis at 2



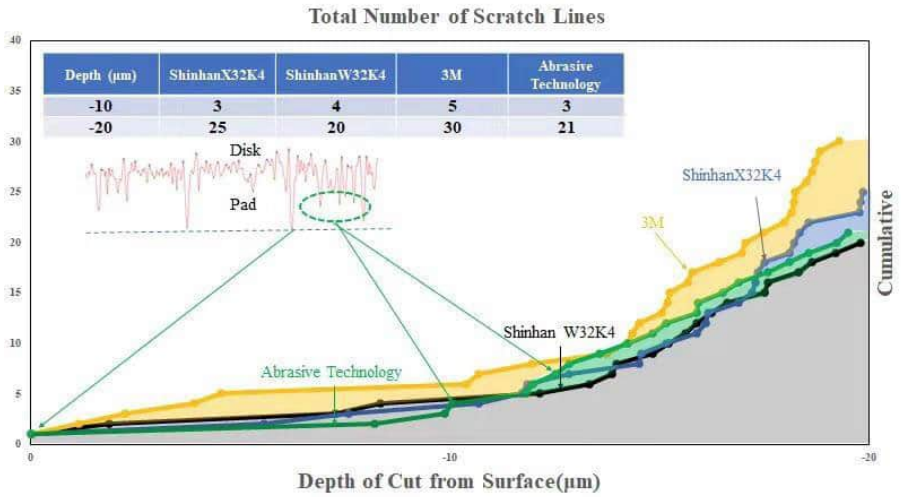
- EHWA PA—EHWA Analysis at 17



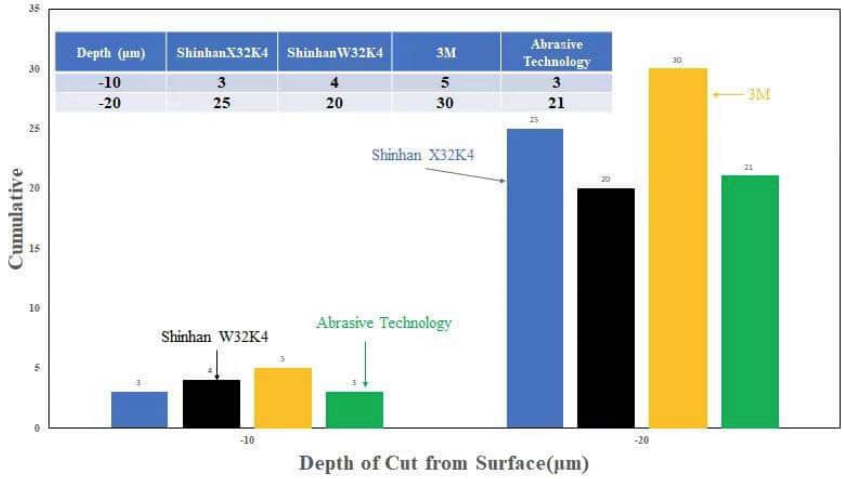
- EHWA PA—EHWA Analysis at 65



- 3M PA and ATI PA—Compl., D.I. 1, Ex. 9 at 8



- 3M PA and ATI PA—Compl., D.I. 1, Ex. 9 at 9



- ATI PA—AT000093 at 4



- ATI PA—AT000280 at 20

[redacted]



- ATI PA—AT000280 at 30

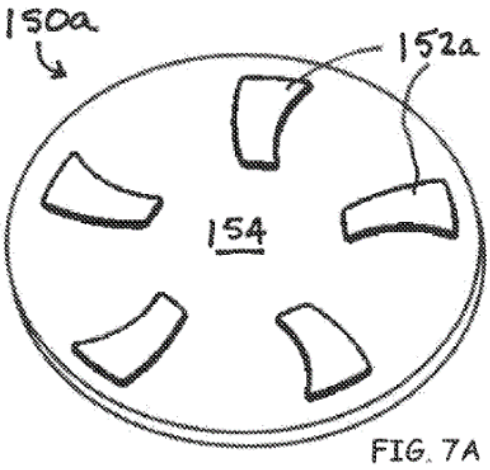


- Smith at 15:19-27 (“Herein, “centrally located protrusions” refers to a subset of protrusions located in a field region or an area of the substrate or segment proximate a center point or center of mass of the substrate (or segment), the subset of protrusions extending toward one or more edges of the substrate. "***Peripherally located protrusions" refers to protrusions located in an edge region of the***

[redacted]

substrate or segment that originate at a leading edge or rim of the substrate and extend inwardly. In some embodiments of the invention, the area of the peripherally located protrusions can be between 0.5% and 75% of the area of the substrate, in other versions the area of peripherally located protrusions can be between 10% and 35% of the area of the substrate.").

- Smith, Fig. 7A



- Ishizuka, Fig. 6

[redacted]



Fig. 6: The commercial ADD samples for ECMP in the front and the state-of-the-art CMP pad conditioner DiaGrid® disks lying in the backside.

- Kinik298 at [0109] ("The PCT cutting pieces can be arranged on the stainless steel plate in an ***annular ring pattern***, circular plates, squares, etc. These patterns can be optimized to suit a particular CMP application.").
- Kinik298 Fig. 1A

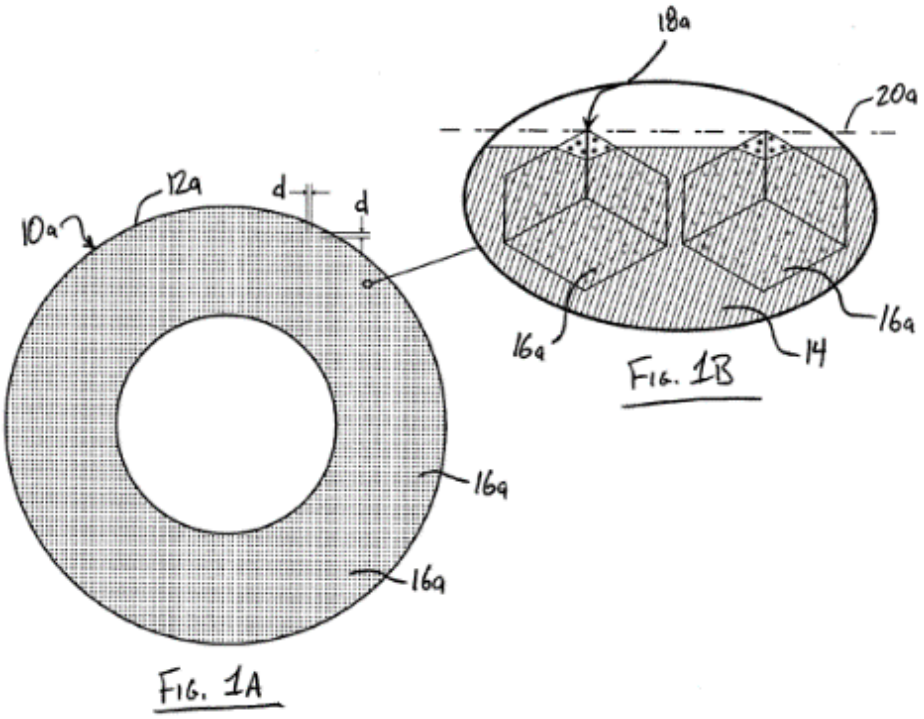


FIG. 1B

FIG. 1A

- Sung479 at [0040] ("As used herein, "***peripherally located***," "particles in a ***peripheral location***" and the like, mean any particle of a tool that is located in an area that ***originates at the leading edge or outer rim of a tool and extends inwardly towards the center for up to about 90% of the radius of the tool***. ***In some aspects, the area may extend inwardly from about 20% to 90% of the radius. In other aspects, the area may extend in to about 50% of the radius. In yet another aspect, the area may extend in to about 33% of the radius of a dresser*** (i.e. 66% away from the center).").
- Kinik2008 Figure 9

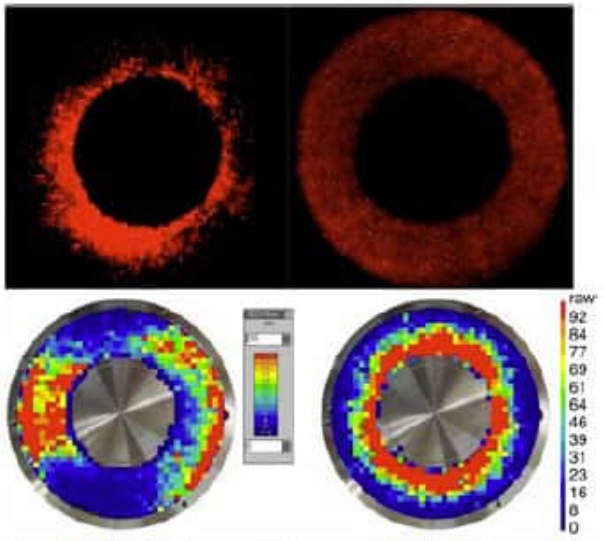
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Figure 9 The commercial ADD samples for ECMP in the front and the state-of-the-art CMP pad conditioner DiaGrid® disks lying in the backside (see online version for colours)



- Kinik2008 Figure 10:

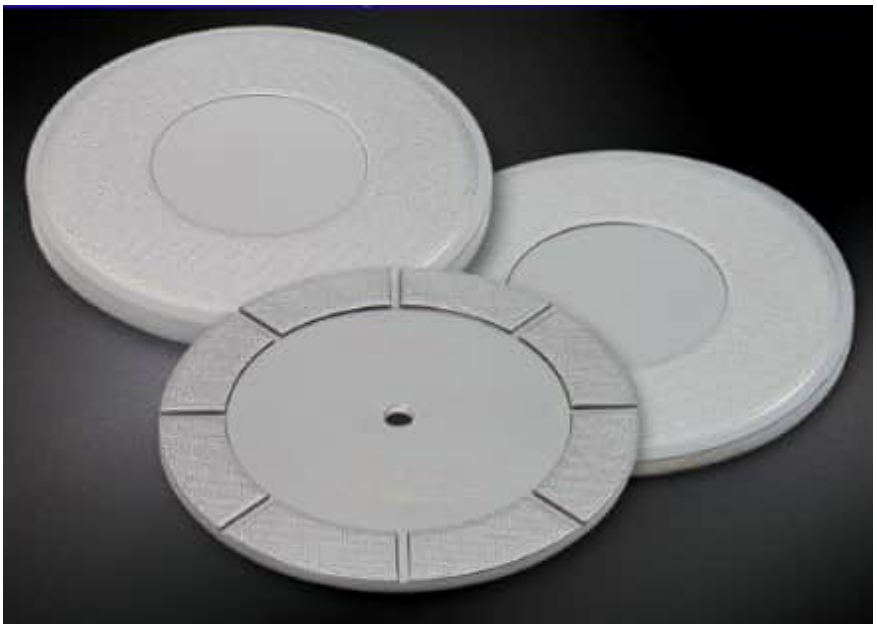
Figure 10 Distorted ADD (left diagrams) versus isotropic ADD (right diagrams) (see online version for colours)



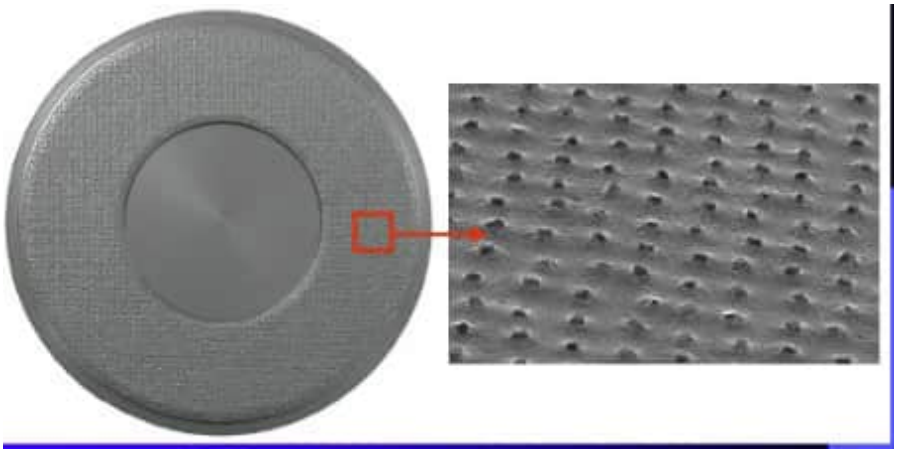
Note: The red colour marks the high points of the pyramid tips that may cutting deeper into the pad.

- CMPUG2009, Slide 2:

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- CMPUG2009, Slide 4



IV. INVALIDITY OF THE ’862 PATENT

A. Invalidity Due to Anticipation Under 35 U.S.C. § 102

A claimed invention is anticipated if “each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987).

[redacted]

The Asserted Claims of the ’862 Patent are invalid under § 102(a) because the claimed subject matter “was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent.” 35 U.S.C. § 102(a). “The statutory language ‘known or used by others in this country’ means knowledge or use which is accessible to the public.” *Carellav. Starlight Archery*, 804 F.2d 135, 231 USPQ 644 (Fed. Cir. 1986). Knowledge or use is accessible to the public if there has been no deliberate attempt to keep it secret. *W. L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).” MPEP §2132.

The Asserted Claims of the ’862 Patent are also invalid under § 102(b) because the claimed subject matter was “patented or described in a printed publication in this or a foreign country,” was “in public use” in the U.S., and/or were “on sale” in the U.S. more than one year prior to the date of the application for patent in the United States. 35 U.S.C. § 102(b). Anticipatory public use under § 102(b) is any use of the claimed invention “by a person other than the inventor who is under no limitation, restriction or obligation of secrecy to the inventor.” *Netscape Commc'ns Corp. v. Konrad*, 295 F.3d 1315, 1320 (Fed. Cir. 2002) (citations omitted). The public use bar is triggered “where, before the critical date, the invention is in public use and ready for patenting.” *Barry v. Medtronic, Inc.*, 914 F.3d 1310, 1320 (Fed. Cir. 2019).

“When a particular publication, use, or sale can be applied under either section 102(a) or (b), it qualifies as prior art if it meets either test. First, pursuant to section 102(b) (either alone or in combination with section 103), all publication, uses, and sales occurring more than one year before the filing date of a U.S. patent application constitute prior art, regardless of the actual invention date. Second, when a publication, use, or sale occurs between the one-year ‘critical date’ and the U.S. filing date, it constitutes prior art under section 102(a) (either alone or in combination

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with section 103) unless the patent applicant can establish a date of invention that precedes the date that the art became public." *Novo Nordisk A/S v. Caraco Pharm. Lab'ys, Ltd*., No. 05-40188, 2010 WL 2403041, at *4 (E.D. Mich. June 9, 2010).

The Asserted Claims are also invalid under § 102(e) because the claimed subject matter was described in "an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent" or "a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language." 35 U.S.C. § 102(e).

A claim is anticipated if "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). A method claim can be invalid for being anticipated by a prior art product when the method claim "simply define[s] what happens when that [product] is placed in the environment in which the [product] will be used." *In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986); *see also Enzo Biochem, Inc. v. Gen-Probe, Inc*., 424 F.3d 1276, 1285 (Fed. Cir. 2005) ("[T]he offer to sell the compositions invalidates [method of use claims] based on those same [products].").

As detailed in Section II.A above, the Asserted Claims of the '862 Patent is not entitled to a priority date before March 13, 2013. At least under the proper priority date, and subject to the reservation of rights set forth above and based on Defendants' present understanding of the

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Asserted Claims of the ’862 Patent, and the apparent application of claim terms Plaintiff is asserting based on its Infringement Contentions, Defendants contend the following:

- Saesol PA anticipates at least claims 1–13, 15, and 17–20 of the ’862 Patent.
- Shinhan PA anticipates at least claims 1–13, 15, and 17–20 of the ’862 Patent.
- EHWA PA anticipates at least claims 1–13, 15, and 17–20 of the ’862 Patent.
- 3M PA anticipates at least claims 1–13, 15, and 17–20 of the ’862 Patent.
- ATI PA anticipates at least claims 1–13, 15, and 17–20 of the ’862 Patent.
- Smith anticipates at least claims 1–12 and 20 of the ’862 Patent.
- Ishizuka anticipates at least claims 1–7, 9–13, 15, and 17–20 of the ’862 Patent.
- Kinik298 anticipates at least claims 1, 5, 9–13, and 15 of the ’862 Patent.
- Liao anticipates at least claims 1, 3, 4, 11, and 20 of the ’862 Patent.
- Sung479 anticipates at least claims 1, 11, 12, and 20 of the ’862 Patent.
- Kink2008 anticipates at least claims 1–7, 9–13, 15, and 17–20 of the ’862 Patent.

1. Saesol PA

Exhibit 862-1 contains a claim chart demonstrating that Saesol PA, including 4DNS80AMC1, HLPX-MD08_M (also known as HLPX-DH3661 or LPX-DH3661), EK45_AM13BSL8031C1-PMF_24, and AM32R80C1-MF included and/or taught each and every element of the Asserted Claims of the ’862 Patent, at least under Plaintiff’s apparent application of its claims. Saesol PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.1. As shown in Exhibit 862-1, at least under Plaintiff's apparent application of its claims, Saesol PA included and/or taught all claimed features of the ’862 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “pressing a CMP pad dresser against a CMP pad, the dresser including a

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monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

2. Shinhan PA

Exhibit 862-2 contains a claim chart demonstrating that Shinhan PA, including PNC01D, 99102, CMP-E-M49-AC, 99561, 99004, 99086, PNC07B, and ARIX-R, included and/or taught each and every element of the Asserted Claims of the '862 Patent, at least under Plaintiff's apparent application of its claims. Shinhan PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.2. As shown in Exhibit 862-2, at least under Plaintiff's apparent application of its claims, Shinhan PA included and/or taught all claimed features of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

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3. EHWA PA

Exhibit 862-3 contains a claim chart demonstrating that EHWA PA, including BSL-CMP (e.g., serial numbers 00315036, [redacted], [redacted]) and CVD-CMP, included and/or taught each and every element of the Asserted Claims of the '862 Patent, at least under Plaintiff's apparent application of its claims. EHWA PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.3. As shown in Exhibit 862-3, at least under Plaintiff's apparent application of its claims, EHWA PA included and/or taught all claimed features of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

4. 3M PA

Exhibit 862-4 contains a claim chart demonstrating that 3M PA, including 3M-A160, 3M-2810, 3M-A3700, and 3M-A82, included and/or taught each and every element of the Asserted Claims of the '862 Patent, at least under Plaintiff's apparent application of its claims. 3M PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.4. As shown in Exhibit 862-4, at least under Plaintiff's apparent application of its claims, 3M PA included and/or taught all claimed features of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example,

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"pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

Sung initially alleged in the Complaint that Defendants infringe at least claim 1 of the '862 Patent on the basis that 3M's Diamond CMP Pad Conditioner meets claim 1 of the '862 Patent. *See* D.I., 1, ¶35; *id.,* Ex. 4. Accordingly, under at least the apparent constructions in the Complaint, 3M PA anticipates at least claim 1 of the '862 Patent.

Also, Sung asserts in a co-pending litigation that Texas Instruments Inc. ("TI") infringes the Asserted Claims of the '862 Patent on the basis that TI uses 3M Diamond CMP Pad Conditioners. *See Sung v. Tex. Instruments Inc.*, Case No. 4:23-cv-00723 (E.D. Tex.) ("TI Action"), D.I. 28 ("TI's Motion for Summary Judgment of Invalidity," or "TI MSJ" in short). Accordingly, under at least the Plaintiff's apparent constructions in its infringement contentions in the TI Action, 3M PA invalidates the Asserted Claims of the '862 Patent.

5. ATI PA

Exhibit 862-5 contains a claim chart demonstrating that ATI PA, including ATI-Infinity II and ATI-Infinity Ver. 6.1, included and/or taught each and every element of the Asserted Claims of the '862 Patent, at least under Plaintiff's apparent application of its claims. ATI PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.5. As shown in Exhibit 862-5, at least under Plaintiff's apparent application of its claims, ATI PA included and/or taught all claimed features of the '862

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Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

Also, Sung initially alleged in the Complaint that Defendants infringe at least claim 1 of the '862 Patent on the basis that ATI-Infinity II meets claim 1 of the '862 Patent. *See* D.I. 1, ¶35; *id.,* Ex. 7. Accordingly, under at least the apparent constructions in the Complaint, ATI PA anticipates at least claim 1 of the '862 Patent.

6. Smith

Exhibit 862-6 contains a claim chart demonstrating that Smith discloses each and every element of claims 1–12 and 20 of the '862 Patent, at least under Plaintiff's apparent application of its claims. Smith was filed on March 6, 2012 and published on September 13, 2012, which is before the proper priority date. *See* Exhibit 862-6, cover. As shown in Exhibit 862-6, at least under Plaintiff's apparent application of its claims, Smith discloses all claimed features of at least claims 1–12 and 20 of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer

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of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

7. Ishizuka

Exhibit 862-7 contains a claim chart demonstrating that Ishizuka discloses each and every element of claims 1–7, 9–13, 15, and 17–20 of the '862 Patent, at least under Plaintiff's apparent application of its claims. Ishizuka was published on November 5, 2007, which is before the proper priority date. *See* Exhibit 862-7, cover. As shown in Exhibit 862-7, at least under Plaintiff's apparent application of its claims, Ishizuka discloses all claimed features of at least claims 1–7, 9–13, 15, and 17–20 of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

8. Kink298

Exhibit 862-8 contains a claim chart demonstrating that Kinik298 discloses each and every element of claims 1, 5, 9–13, and 15 of the '862 Patent, at least under Plaintiff's apparent application of its claims. Kinik298 was filed on October 18, 2006, and published on April 24, 2008, which is before the proper priority date. *See* Exhibit 862-8, cover. As shown in Exhibit 862-8, at least under Plaintiff's apparent application of its claims, Kinik298 discloses all claimed features

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of at least claims 1, 5, 9–13, and 15 of the ’862 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less” and “rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns.”

9. Liao

Exhibit 862-9 contains a claim chart demonstrating that Liao discloses each and every element of claims 1, 3, 4, 11, and 20 of the ’862 Patent, at least under Plaintiff’s apparent application of its claims. Liao was published on February 15, 2004, which is before the proper priority date. *See* Exhibit 862-9, cover. As shown in Exhibit 862-9, at least under Plaintiff’s apparent application of its claims, Liao discloses all claimed features of at least claims 1, 3, 4, 11, and 20 of the ’862 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less” and “rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns.”

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10. Sung479

Exhibit 862-10 contains a claim chart demonstrating that Sung479 discloses each and every element of claims 1, 11, 12, and 20 of the '862 Patent, at least under Plaintiff's apparent application of its claims. Sung479 was filed on October 18, 2006 and published on April 24, 2008, which is before the proper priority date. *See* Exhibit 862-10, cover. As shown in Exhibit 862-10, at least under Plaintiff's apparent application of its claims, Sung479 discloses all claimed features of at least claims 1, 11, 12, and 20 of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer, wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles is less than or equal to about 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

11. Kinik2008

Exhibit 862-11 contains a claim chart demonstrating that Kinik2008 discloses each and every element of claims 1–7, 9–13, 15, and 17–20 of the '862 Patent, at least under Plaintiff's apparent application of its claims. Kinik2008 was published on October 1, 2008, which is before the proper priority date. *See* Exhibit 862-11, cover. As shown in Exhibit 862-11, at least under Plaintiff's apparent application of its claims, Sung479 discloses all claimed features of at least claims 1–7, 9–13, 15, and 17–20 of the '862 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "pressing a CMP pad dresser against a CMP pad, the dresser including a monolayer of a plurality of superabrasive particles protruding from a matrix layer,

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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 10 microns and the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less" and "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns."

B. Invalidity Due to Obviousness Under 35 U.S.C. § 103

To the extent that any one of the Asserted Claims of the '862 Patent is not anticipated pursuant to § 102 by any particular prior art reference listed in Section IV.A, any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge of those skilled in the art under § 103. The Asserted Claims contain nothing that goes beyond ordinary design and implementation; no Asserted Claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those skilled in the art.

Specifically, the Asserted Claims of the '862 Patent would have been obvious in view of the prior art combinations identified below for the '862 Patent in Section IV.B.2. In addition to the combinations of prior art and the combinations of groups of prior art disclosed in Section IV.B.2, Defendants further reserve the right to rely on any other combinations of any prior art references disclosed herein or references that become known to Defendants after serving Plaintiff with these Invalidity Contentions. Defendants further reserve the right to rely upon combinations disclosed within the prosecution histories of the references cited herein. These obviousness combinations reflect Defendants' present understanding of the potential scope of the Asserted Claims that

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Plaintiff appears to be advocating and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the Asserted Claims.

A POSITA at the time of the alleged inventions of the '862 Patent would have been motivated to modify or combine the prior art references as set forth in Section IV.B.2 because, *inter alia*: (a) the references in general deal with the same or analogous subject matter of CMP pad dressers and conditioning CMP pads; (b) a POSITA would have been motivated by the problem that the inventor was attempting to solve, or with other problems that would have been faced in reaching a solution, and would have looked to references that concerned similar issues or taught how to overcome the problems faced; (c) the combinations were obvious to try and would have operated in their known and expected way; (d) the combinations were within the technical skill and understanding of a POSITA; I the combinations would have been motivated by the developments in technology; (f) the combinations reflect various design choices that would have been known to a POSITA and within that person's technical capability to implement (i.e., technically feasible); (g) a POSITA of the Asserted Patents would have been motivated to incorporate the benefits into the methods or systems described in the prior art, including to improve various mechanical, structural, durability, and functioning of CMP pad dressers and conditioning CMP pads.

To be clear, Defendants' contentions regarding obviousness are provided in the alternative to any contentions of anticipation and are not to be understood to suggest that any reference is not itself anticipatory. Further, Defendants' contentions reflect Defendants' present understanding of the potential scope of the claims that Plaintiff appears to be advancing and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the Asserted Claims of the '862 Patent.

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1. Invalidity Due To Obviousness

In general, a claimed invention is invalid due to obviousness "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103; *Graham v. John Deere Co.*, 383 U.S. 1, 13 (1966). The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: "(1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the art at the time of invention; and (4) objective evidence of nonobviousness." *Miles Labs., Inc. v. Shandon, Inc.*, 997 F.2d 870, 877 (Fed. Cir. 1993) (citing *Graham*, 383 U.S. at 17–18). The Supreme Court's decision in *KSR Int'l Co. v. Teleflex Inc.* reaffirmed *Graham*, but further held that a claimed invention can be obvious even if there is no explicit teaching, suggestion, or motivation for combining the prior art to produce that invention. 550 U.S. 398, 414–18 (2007).

To determine whether there is a reason to combine the known elements in the manner claimed by a patent, a court can "look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art." *KSR*, 550 U.S. at 418. For example, obviousness can be demonstrated by showing "there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *Id.* at 420. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id*. Common sense also teaches that "familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*.

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Indeed, in assessing obviousness of claims, the Court can consider the inferences and creative steps a person of ordinary skill in the art would employ in combining prior art teachings. *See KSR*, 550 U.S. at 418 ("[A] court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ."). Defendants hereby expressly incorporate by reference any statements and reasons set forth by the examiner during prosecution of the Asserted Patents and related patent applications as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims. Defendants further contend that the prior art identified in these Invalidity Contentions is evidence of simultaneous or near-simultaneous independent invention by others of the alleged inventions recited in one or more of the Asserted Claims. Defendants reserve the right to rely on the simultaneous or near-simultaneous independent invention by others as further evidence of the obviousness of the Asserted Claims. And as previously discussed, Defendants assert that Plaintiff is not entitled to its claimed priority dates for the Asserted Claims of the Asserted Patents. Therefore, Defendants further reserve the right to modify their anticipation and/or obviousness arguments to include additional prior art based on the Court's determination of the proper priority dates of the Asserted Patents.

The references disclosed herein and in the attached charts provide specific motivation to combine prior art. As reflected herein, in the attached Exhibits, and in the references themselves, there was a reason to make each combination—each combination of art would have produced no unexpected results, and each combination at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 414–18 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation-to-combine test, instead espousing an "expansive and flexible" approach). "The combination of familiar elements according to known methods is likely to be obvious when it does no more than

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yield predictable results." *Id.* at 416. Similarly, "[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one," *id.* at 417, and thus "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id*. Indeed, the Supreme Court has held that a person of ordinary skill is "a person of creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*. at 420–21. The Federal Circuit reaffirmed the Supreme Court's rejection of a "rigid approach to determining obviousness" and explained the importance of recognizing the state of the art and "critical background information" relevant to the obviousness analysis. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362–63 (Fed. Cir. 2013).

The obviousness combinations identified below reflect Defendants' present understanding of the potential scope of the claims that Plaintiff appears to be advancing and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the patent claims. To be clear, nothing in the Invalidity Contentions shall be treated as an admission that the accused technology meets any limitations of the Asserted Claims. Defendants deny that they infringe any claim of the Asserted Claims. Nothing stated herein shall be construed as an admission or a waiver of any particular construction of any claim term. Defendants expressly reserve the right to contest any claim construction asserted by Plaintiff and expressly reserves all noninfringement arguments.

2. The '862 Patent Is Obvious Over Numerous Combinations Of Prior Art References

Prior art references rendering the Asserted Claims of the '862 Patent obvious, alone or in combination with other references, are identified and discussed below and are included in the claim

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charts Exhibits 862-1 through 862-12. Exhibits 862-1 through 862-12 include exemplary claim charts for the ’862 Patent showing specific combinations of references, including citations to where in the references the teachings, suggestions, and motivations to combine the references are disclosed. Further reasons to combine the references identified in Exhibits 862-1 through 862-12 include the nature of the problem being solved, the express, implied and inherent teachings of the prior art, the knowledge of persons of ordinary skill in the art, that such combinations would have yielded predictable results, and that such combinations would have represented known alternatives to a person of ordinary skill in the art.

The references cited in Defendants’ exemplary claim charts, Exhibits 862-1 through 862-11, are Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Smith, Ishizuka, Kinik298, Liao, Sung479, and Kinik2008. Each of the references in Exhibits 862-1 through 862-11 discloses and/or suggests all or, at a minimum, the vast majority of the limitations of the Asserted Claims of the ’862 Patent. To the extent any claim elements are found to be missing from a particular reference analyzed in Exhibits 862-1 through 862-11, the claim element would have been rendered obvious by the particular reference in combination with other references analyzed in Exhibits 862-1 through 862-11 and/or with references identified and described in Sections III.E.1 (Conditioning CMP Pads), III.E.2 (Polishing Workpieces), III.E.3 (Pad Dressers with a Monolayer), III.E.4 (Protrusion Distances and Profile), III.E.5 (Cutting CMP Pads), III.E.6 (Number of Working Particles), and III.E.7 (Placement of Particles).

Specifically, subject to the reservation of rights above and based at least on Defendants’ present understanding of the Asserted Claims of the ’862 Patent and Plaintiff’s apparent application of its Asserted Claims, the following Asserted Claims of the ’862 Patent are rendered obvious by the specified combinations of references. For example, each of the references identified

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in Section IV.A can be combined with any one or more of the specific references identified in Sections III.E.1 through III.E.7 and IV.A, and the combinations are not limited solely to those identified below. These specified combinations of references are meant to be illustrative only and are not meant to be limited to only the exemplary combinations explicitly noted below. Moreover, the specific combinations provided herein are not meant to specify which is a primary reference or a secondary reference. In other words, any of the references identified in the specific combinations provided herein may be used as a primary and/or secondary reference.

- Claims 1–13, 15, and 17–20 are obvious over Saesol PA.
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s) and Polishing Workpiece Reference(s).

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- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Cutting Depth Reference(s) and Peripheral Location Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Saesol PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA.
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s) and Peripheral Location Reference(s).

[redacted]

- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Cutting Depth Reference(s) and Peripheral Location Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over Shinhan PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA.
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s).

[redacted]

- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Cutting Depth Reference(s) and Peripheral Location Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over EHWA PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA.
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).

[redacted]

- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over 3M PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA.
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s) and Peripheral Location Reference(s).

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- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Protrusion/Profile Reference(s) and Cutting Depth Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s) and Protrusion/Profile Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s) and Protrusion/Profile Reference(s) and Working Particles Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Cutting Depth Reference(s) and Protrusion/Profile Reference(s) and Peripheral Location Reference(s).
- Claims 1–13, 15, and 17–20 are obvious over ATI PA and Conditioning Pad Reference(s) and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–13 and 20 are obvious over Smith.

[redacted]

- Claims 1–13 and 20 are obvious over Smith and Cutting Depth Reference(s).
- Claims 13, 15, and 17–19 are obvious over Smith and Polishing Workpiece Reference(s).
- Claims 13, 15, and 17–19 are obvious over Smith and Cutting Depth Reference(s) and Polishing Workpiece Reference(s).
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Ishizuka.
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Ishizuka and Monolayer Reference(s).
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Ishizuka and Cutting Depth Reference(s).
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Ishizuka and Monolayer Reference(s) and Cutting Depth Reference(s).
- Claim 8 is obvious over Ishizuka and Peripheral Location Reference(s).
- Claim 8 is obvious over Ishizuka and Monolayer Reference(s) and Peripheral Location Reference(s).
- Claim 8 is obvious over Ishizuka and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claim 8 is obvious over Ishizuka and Monolayer Reference(s) and Cutting Depth Reference(s) and Peripheral Location Reference(s).
- Claims 1, 5, 9–13, and 15 are obvious over Kinik298.
- Claims 2–4 are obvious over Kinik298 and Working Particle Reference(s).
- Claims 6–8 are obvious over Kinik298 and Peripheral Location Reference(s).

[redacted]

- Claims 15 and 17–19 are obvious over Kinik298 and Polishing Workpiece Reference(s).
- Claim 20 is obvious over Kinik298 and Conditioning Pad Reference(s).
- Claims 1, 3–4, 11, and 20 are obvious over Liao.
- Claim 2 is obvious over Liao and Working Particles Reference(s).
- Claims 5–10 are obvious over Liao and Peripheral Location Reference(s).
- Claim 12–13, 15, and 17–19 are obvious over Liao and Polishing Workpiece Reference(s).
- Claims 1, 3–4, 11, and 20 are obvious over Liao and Monolayer Reference(s).
- Claim 2 is obvious over Liao and Monolayer Reference(s) and Working Particles Reference(s).
- Claims 5–10 are obvious over Liao and Monolayer Reference(s) and Peripheral Location Reference(s).
- Claim 12–13, 15, and 17–19 are obvious over Liao and Monolayer Reference(s) and Polishing Workpiece Reference(s).
- Claims 1, 11, 12, and 20 are obvious over Sung479.
- Claims 2–4 are obvious over Sung479 and Working Particles Reference(s).
- Claims 5–10 are obvious over Sung479 and Peripheral Location Reference(s).
- Claims 13, 15, and 17–19 are obvious over Sung479 and Polishing Workplace Reference(s).
- Claims 1, 11, 12, and 20 are obvious over Sung479 and Conditioning Pad Reference(s).

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- Claims 2–4 are obvious over Sung479 and Conditioning Pad Reference(s) and Working Particles Reference(s).
- Claims 5–10 are obvious over Sung479 and Conditioning Pad Reference(s) and Peripheral Location Reference(s).
- Claims 13, 15, and 17–19 are obvious over Sung479 and Conditioning Pad Reference(s) and Polishing Workplace Reference(s).
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Kinik2008.
- Claim 8 is obvious over Kinik2008 and Peripheral Location Reference(s).
- Claims 1–7, 9–13, 15, and 17–20 are obvious over Kinik2008 and Monolayer Reference(s).
- Claim 8 is obvious over Kinik2008 and Monolayer Reference(s) and Peripheral Location Reference(s).

More specifically, and subject to the reservations provided above, the following Asserted Claims of the ’862 Patent are rendered obvious by the exemplary references alone or with combinations of references provided below. These exemplary combinations of references are meant to be illustrative only and are not meant to be limiting in any way. For example, each reference in Section IV.A can be combined with any one of the references identified in Sections III.E.1 through III.E.7, IV.A, IV.D and in Exhibits 862-1 to 862-12.

’862 Patent, Claims 1–13, 15, and 17–20

- Any one of Saesol PA, Shinhan PA, EHWA PA, 3M PA, or ATI PA alone[12]
- Product PA and CMPUG2009

[12] Any one of Saesol PA, Shinhan PA, EHWA PA, 3M PA, or ATI PA is referred to as “Product PA” in these Invalidity Contentions.

[redacted]

- Product PA and Smith
- Product PA and Kinik2008
- Product PA and Kinik869
- Product PA and Liao
- Product PA and CMPUG2009
- Product PA and Smith and Kinik2008
- Product PA and Smith and Kinik869
- Product PA and Smith and Liao
- Product PA and Smith and CMPUG2009
- Product PA and Kinik2008 and Kinik869
- Product PA and Kinik2008 and Liao
- Product PA and CMPUG2009
- Product PA and Kinik869 and Liao
- Product PA and Kinik869 and CMPUG2009
- Product PA and Liao and CMPUG2009
- Product PA and Smith and Kinik2008 and Kinik869
- Product PA and Smith and Kinik2008 and Liao
- Product PA and Smith and Kinik2008 and CMPUG2009
- Product PA and Smith and Kinik869 and Liao
- Product PA and Smith and Kinik869 and ;CMPUG2009
- Product PA and Smith and Liao and CMPUG2009
- Product PA and Kinik2008 and Kinik869 and Liao
- Product PA and Kinik2008 and Kinik869 and CMPUG2009

[redacted]

- Product PA and Kinik869 and Liao and CMPUG2009
- Product PA and Smith and Kinik2008 and Kinik869 and Liao
- Product PA and Smith and Kinik2008 and Kinik869 and CMPUG2009
- Product PA and Kinik2008 and Kinik869 and Liao and CMPUG2009
- Product PA and Smith and Kinik2008 and Kinik869 and Liao and CMPUG2009
- Product PA and Van Buskirk
- Product PA and Gambino
- Product PA and Smith and Van Buskirk
- Product PA and Smith and Gambino
- Product PA and Kinik2008 and Van Buskirk
- Product PA and Kinik2008 and Gambino
- Product PA and Kinik869 and Van Buskirk
- Product PA and Kinik869 and Gambino
- Product PA and Liao and Van Buskirk
- Product PA and Liao and Gambino
- Product PA and Van Buskirk and Gambino
- Product PA and Smith and Kinik2008 and Van Buskirk
- Product PA and Smith and Kinik2008 and Gambino
- Product PA and Kinik2008 and Kinik869 and Van Buskirk
- Product PA and Kinik2008 and Kinik869 and Gambino
- Product PA and Kinik869 and Liao and Van Buskirk
- Product PA and Kinik869 and Liao and Gambino
- Product PA and Liao and ;Van Buskirk and Gambino

[redacted]

- Product PA and Smith and Kinik2008 and Kinik869 and Van Buskirk
- Product PA and Smith and Kinik2008 and Kinik869 and Gambino
- Product PA and Kinik2008 and Kinik869 and Liao and Van Buskirk
- Product PA and Kinik2008 and Kinik869 and Liao and Gambino
- Product PA and Kinik869 and Liao and Van Buskirk and Gambino
- Product PA and Smith and Kinik2008 and Kinik869 and Liao and Van Buskirk
- Product PA and Smith and Kinik2008 and Kinik869 and Liao and Gambino
- Product PA and Kinik2008 and Kinik869 and Liao and Van Buskirk and Gambino
- Product PA and Smith and Kinik2008 and Kinik869 and Liao and Van Buskirk and Gambino

’862 Patent, Claims 1 and 11

- Smith alone
- Smith and Liao
- Smith and Kinik2008
- Smith and Kinik869
- Smith and Liao and Kinik2008
- Smith and Liao and Kinik869
- Smith and Kinik2008 and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao

[redacted]

- Ishizuka and Kinik2008
- Ishizuka and Sung479
- Ishizuka and CMPUG2009
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Lawing and CMPUG2009
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and Kinik2008
- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Lawing and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao

[redacted]

- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik298 and Liao and Kinik2008
- Ishizuka and Kinik298 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Kinik2008 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Kinik298 alone
- Liao alone
- Liao and Kinik298
- Liao and Lawing
- Liao and Kinik869
- Liao and CMPUG2009

[redacted]

- Liao and Kinik298 and Lawing
- Liao and Kinik298 and Kinik869
- Liao and Kinik298 and CMPUG2009
- Liao and Lawing and Kinik869
- Liao and Lawing and CMPUG2009
- Liao and Kinik298 and Lawing and Kinik869
- Sung479 alone
- Sung479 and Smith
- Sung479 and Kinik2008
- Sung479 and Kinik869
- Sung479 and CMPUG2009
- Sung479 and Smith and Kinik2008
- Sung479 and Smith and Kinik869
- Sung479 and Smith and CMPUG2009
- Sung479 and Smith and Kinik2008 and Kinik869
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Kinik298 and CMPUG2009

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[redacted]

- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and CMPUG2009
- Kinik2008 and Kinik869 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869 and CMPUG2009

'862 Patent, Claim 2

- Smith alone
- Smith and Liao
- Smith and Kinik2008
- Smith and Kinik869
- Smith and CMPUG2009
- Smith and Liao and CMPUG2009
- Smith and Kinik2008 and CMPUG2009
- Smith and Kinik869 and CMPUG2009
- Smith and Liao and Kinik2008
- Smith and Liao and Kinik869
- Smith and Liao and CMPUG2009
- Smith and Kinik2008 and Kinik869
- Smith and Kinik2008 and CMPUG2009
- Smith and Kinik869 and CMPUG2009
- Ishizuka alone
- Ishizuka and Kinik298

[redacted]

- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and CMPUG2009
- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Lawing and CMPUG2009
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Lawing and CMPUG2009
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and Kinik2008

[redacted]

- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Lawing and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik298 and Liao and Kinik2008
- Ishizuka and Kinik298 and Liao and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and CMPUG2009

[redacted]

- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Kinik298 and Smith
- Kinik298 and Kinik2008
- Kinik298 and CMPUG2009
- Kinik298 and Smith and Kinik2008
- Kinik298 and Smith and CMPUG2009
- Kinik298 and Kinik 2008 and CMPUG2009
- Kinik298 and Smith and Kinik2008 and CMPUG2009
- Liao and CMPUG2009
- Liao and Kinik2008
- Liao and Kinik2008 and CMPUG2009
- Liao and Kinik298 and Smith
- Liao and Kinik298 and Kinik2008
- Liao and Kinik298 and CMPUG2009
- Liao and Kinik298 and Lawing and Smit
- Liao and Kinik298 and Lawing and Kinik2008
- Liao and Kinik298 and Lawing and CMPUG2009
- Liao and Kinik298 and Lawing and Kinik869 and Smith
- Liao and Kinik298 and Lawing and Kinik869 and Kinik2008
- Liao and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Liao and Kinik298 and Lawing and Kinik869 and Smith and Kinik2008
- Liao and Kinik298 and Lawing and Kinik869 and Smith and CMPUG2009

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- Liao and Kinik298 and Lawing and Kinik869 and Smith and Kinik2008 and CMPUG2009
- Liao and Kinik869 and Smith
- Liao and Kinik869 and Kinik2008
- Liao and Kinik869 and CMPUG2009
- Liao and Kinik869 and Smith and Kinik2008
- Liao and Kinik869 and Smith and CMPUG2009
- Liao and Kinik869 and Smith Kinik2008 and CMPUG2009
- Liao and Lawing and Smith
- Liao and Lawing and Kinik2008
- Liao and Lawing and CMPUG2009
- Liao and Lawing and Kinik869 and Smith
- Liao and Lawing and Kinik869 and Kinik2008
- Liao and Lawing and Kinik869 and CMPUG2009
- Liao and Lawing and Kinik869 and Smith and Kinik2008
- Liao and Lawing and Kinik869 and Smith and CMPUG2009
- Liao and Lawing and Kinik869 and Smith and Kinik2008 and CMPUG2009
- Liao and Smith
- Liao and Smith and Kinik2008
- Liao and Smith and CMPUG2009
- Liao and Smith and Kinik2008 and CMPUG2009
- Sung479 and CMPUG2009
- Sung479 and Smith and CMPUG2009

[redacted]

- Sung479 and Kinik2008 and CMPUG2009
- Sung479 and Kinik869 and CMPUG2009
- Sung479 and Smith and Kinik2008 and CMPUG2009
- Sung479 and Smith and Kinik869 and CMPUG2009
- Sung479 and Smith and Kinik2008 and Kinik869 and CMPUG2009
- Sung479 and Smith
- Sung479 and Kinik2008
- Sung479 and Smith and Kinik2008
- Sung479 and Smith and Kinik869
- Sung479 and Smith and Kinik2008 and Kinik869
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Kinik298 and CMPUG2009
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and CMPUG2009
- Kinik2008 and Kinik869 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and CMPUG2009

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’862 Patent, Claims 3 and 4

- Smith alone
- Smith and Liao
- Smith and Kinik2008
- Smith and Kinik869
- Smith and CMPUG2009
- Smith and Liao and Kinik2008
- Smith and Liao and Kinik869
- Smith and Liao and CMPUG2009
- Smith and Kinik2008 and Kinik869
- Smith and Kinik2008 and CMPUG2009
- Smith and Kinik869 and CMPUG2009
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and CMPUG2009
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008

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- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Lawing and CMPUG2009
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and Kinik2008
- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Lawing and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik298 and Liao and Kinik2008
- Ishizuka and Kinik298 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Kinik2008 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008

[redacted]

- Ishizuka and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Kinik298 and Smith
- Kinik298 and Kinik2008
- Kinik298 and CMPUG2009
- Kinik298 and Smith and Kinik2008
- Kinik298 and Smith and CMPUG2009
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’862 Patent, Claims 5 and 9–10

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- Kinik2008 and Kinik869

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- Liao and Kinik298 and Lawing and Kinik869 and Smith
- Liao and Kinik298 and Lawing and Kinik869 and Kinik2008
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- Liao and Lawing and Kinik869 and Smith and Kinik2008
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- Kinik2008 and CMPUG2009
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- Kinik2008 and Kinik298 and Smith
- Kinik2008 and Kinik298 and CMPUG2009
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- Kinik2008 and Kinik298 and Lawing and Kinik869 and CMPUG2009
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’862 Patent, Claim 12

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’862 Patent, Claim 13

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’862 Patent, Claim 15

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- Smith and Gambino
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’862 Patent, Claims 17–19

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- Sung479 and Kinik869 and Kinik2008 and Van Buskirk
- Sung479 and Kinik869 and Kinik2008 and Gambino
- Sung479 and Kinik2008 and Van Buskirk and Gambino
- Sung479 and Smith and Kinik2008 and Kinik869 and Van Buskirk
- Sung479 and Smith and Kinik2008 and Kinik869 and Gambino
- Sung479 and Kinik2008 and Kinik869 and Van Buskirk
- Sung479 and Kinik2008 and Kinik869 and Gambino

[redacted]

- Sung479 and Kinik869 and Kinik2008 and Van Buskirk and Gambino
- Sung479 and Smith and Kinik2008 and Kinik869 and Van Buskirk
- Sung479 and Smith and Kinik2008 and Kinik869 and Gambino
- Sung479 and Kinik2008 and Kinik869 and Van Buskirk and Gambino
- Sung479 and Smith and Kinik2008 and Kinik869 and Van Buskirk and Gambino
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Kinik869

’862 Patent, Claim 20

- Smith alone
- Smith and Liao
- Smith and Kinik2008
- Smith and Kinik869
- Smith and Liao and Kinik2008
- Smith and Liao and Kinik869
- Smith and Kinik2008 and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298

[redacted]

- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Liao and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and Liao and Kinik2008

[redacted]

- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Kinik298 and Smith
- Kinik298 and Kinik2008
- Kinik298 and Kinik869
- Kinik298 and Smith and Kinik2008
- Kinik298 and Smith and Kinik869
- Kinik298 and Smith and Kinik2008 and Kinik869
- Liao alone
- Liao and Kinik298
- Liao and Lawing
- Liao and Kinik869
- Liao and Kinik298 and Lawing
- Liao and Kinik298 and Kinik869
- Liao and Lawing and Kinik869
- Liao and Kinik298 and Lawing and Kinik869
- Sung479 alone
- Sung479 and Smith
- Sung479 and Kinik2008
- Sung479 and Kinik869
- Sung479 and Smith and Kinik2008

[redacted]

- Sung479 and Smith and Kinik869
- Sung479 and Smith and Kinik2008 and Kinik869
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Kinik869

To the extent a finder of fact finds that a limitation of a given claim was not disclosed by one of the references identified above, those claims are nevertheless unpatentable as obvious because the asserted claims contain nothing that goes beyond ordinary creativity. To the extent not anticipated, no asserted claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art, particularly in view of the state of the art as reflected in the relevant references listed above in Sections III.E.1 (Conditioning CMP Pads), III.E.2 (Polishing Workpieces), III.E.3 (Pad Dressers with a Monolayer), III.E.4 (Protrusion Distances and Profile), III.E.5 (Cutting CMP Pads), III.E.6 (Number of Working Particles), and III.E.7 (Placement of Particles).

a. Reasons For Modifications And/Or Combinations

Applying the principles of obviousness described in Section IV.B.1, it would have been obvious to a person of ordinary skill in the art at the time of the priority date of the ’862 Patent to combine, modify, or use the teachings of the prior art to make the purported inventions of those

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patents, including by making each of the combinations identified above. The motivation to combine the teachings of the prior art references disclosed herein can be found in each of (1) the references themselves, (2) the nature of the problem being solved, (3) the express, implied and inherent teachings of the prior art, (4) the knowledge of persons of ordinary skill in the art, (5) the fact that the prior art is generally directed towards the subject matter of each respective asserted patent, and (6) the predictable results obtained in combining the elements of the prior art.

Any reference or combination of references that anticipates or makes obvious an asserted independent claim also makes obvious any asserted claim dependent on that independent claim because every element of each dependent claim was known by a person of ordinary skill at the time of the alleged invention, and it would have been obvious to combine those known elements with the independent claim at least as a matter of common sense and routine development.

Numerous prior art references, including those identified above and in the Exhibits, reflect common knowledge and the state of the prior art before the priority date of the '862 Patent. Because it would be unduly burdensome to create detailed claim charts for the many invalidating combinations, Defendants have provided illustrative examples of such invalidating combinations herein and in Exhibits 862-1 through 862-12. For at least the reasons described in the examples provided, as well as in the attached claim charts, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those identified in Exhibits 862-1 through 862-12, to meet the limitations of the asserted claims. As such, Defendants' identification of exemplary combinations is without limitation to Defendants identifying other invalidating combinations as appropriate.

Given the benefits of improving the mechanical, structural, durability, and functioning of CMP pad dressers and the conditioning of CMP pads as well as polishing of semiconductor

devices, a person of ordinary skill in the art at the time of the purported invention would have been motivated to combine the teachings on the structure, tip variation, protrusion distance, heights of particles, pattern of particles of the CMP pad dressers, methods for rotating and cutting on CMP pad, and polishing semiconductor devices, of the prior art references in Defendants' claim charts to develop a method of conditioning a CMP pad dresser that meets the Asserted Claims of the '802 Patent. Therefore, to the extent not anticipated fully by any single given reference, it would have been obvious to one skilled in the art to combine features of mechanical and structural properties of CMP pad dressers as well as methods of conditioning and polishing.

i. Reasons To Combine With Conditioning Pad References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found obvious a method for conditioning a CMP pad by pressing a CMP pad dresser against a rotating polyurethane CMP pad. For example, as disclosed in the Conditioning CMP Pad References discussed in Section III.E.1, it was well known that a rotating polyurethane CMP pad can be conditioned by pressing CMP pad dresser against it.

A person of ordinary skill in the art would have been motivated to press a CMP pad dresser against rotating a CMP pad because it was well known that a CMP process commonly includes conditioning a CMP pad with a rotating CMP pad dresser while the CMP pad is being rotated to process a work piece.

A person of ordinary skill in the art would have been motivated to press a CMP pad dresser against CMP pad because the CMP pad conditioner needs to contact the CMP pad to condition it—a CMP pad conditioner conditions a CMP pad through, at least in part, a physical abrasion. As such, this combination would have amounted to a mere combination of prior art elements according to known methods to yield predictable results. At minimum, it would have been obvious to try to press the CMP pad dresser against the CMP pad to condition it, and a person would have

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a reasonable expectation of success in doing So given the wealth of common knowledge in the CMP space.

A person of ordinary skill in the art would have found it obvious to use a CMP pad made of polyurethane because, as disclosed in the Conditioning CMP Pad References discussed in Section III.E.1, polyurethane is a common, if not the most common, material used for CMP pads. Accordingly, a person of ordinary skill in the art would have been motivated to use a polyurethane pad with a reasonable expectation of success. At a minimum, it would have been obvious to try a CMP pad made of polyurethane because such CMP pad was one of finite number of identified, predictable potential solutions to the recognized need or problem, and a POSITA would have had a reasonable expectation of success that the CMP pad would flatten intermediate layers of a semiconductor workpiece.

A person of ordinary skill in the art would have found it trivial and straightforward, and would have had a reasonable expectation of success to use a polyurethane CMP pad in a CMP process.

A person of ordinary skill in the art would have found it obvious to use a polyurethane CMP pad in a CMP process to yield predictable results of polishing a semiconductor work piece because each of those elements was known in the prior art and one skilled in the art would have been able to combine the elements by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art.

At minimum, a person of ordinary skill in the art would have found it obvious to try to use a polyurethane CMP pad in the process, because there were only a finite number of CMP pads, each with a reasonable expectation of success.

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A person of ordinary skill in the art would have been motivated to rotate the CMP pad during the CMP pad conditioning process because, as provided in the Conditioning CMP Pad References discussed in Section III.E.1, a CMP pad is typically rotated during the CMP process. As such, this combination amounts to mere combining of prior art elements according to known methods to yield predictable results. At minimum, it would have been obvious to try to rotate the CMP pad, and a person would have a reasonable expectation of success in doing so.

ii. Reasons To Combine With Polishing Workpiece References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to apply a slurry to the rotating CMP pad and polishing a workpiece—such as a semiconductor device—by applying the workpiece to the CMP pad. It would have also been obvious to apply the polishing technique to a semiconductor device having certain linewidths, such as 30 nm or less, and/or various metallic and non-metallic materials, such as copper, tungsten, oxide, or combinations of those materials.

For example, as disclosed in the Polishing Workpiece References discussed in Section III.E.2, it was well known that a CMP process is used for polishing semiconductor devices, including those with a line width of 30 nm or less.

A person of ordinary skill in the art would have been motivated to use a CMP process in manufacturing semiconductor devices, including those with a line width of 30 nm or less because it was conventional to fabricate a semiconductor device using a CMP process as one of thousands of intermediate fabrication steps. Such combination would have yielded predictable results because one skilled in the art would have been able to combine these elements by known methods with no changes in their respective functions, and the combination yielded nothing more than predictable results of flattening one of many intermediate layers of a semiconductor device.

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A person of ordinary skill in the art would have found it trivial to use the CMP process to polish a semiconductor device, including one having a line width of 30 nm or less, at least because using a CMP process (as one of thousands of semiconductor fabrication processes) was routine for semiconductor devices, including those having a line width of 30 nm or less. At minimum, a person of ordinary skill in the art would have found it obvious to try to use a CMP process to polish a semiconductor device, including one having a line width of 30 nm or less.

Furthermore, a person of ordinary skill in the art would have been motivated to apply the CMP process to semiconductor device having layers of one or more of copper, tungsten or an oxide, at least because, as disclosed in the Polishing Workpiece References discussed in Section III.E.2, such devices were well known and commonly subjected to a CMP process as one of thousands of semiconductor fabrication processes. Such a combination would have therefore yielded predictable results of flattening one of many intermediate layers of a semiconductor device. Such combination would have yielded predictable results because one skilled in the art would have been able to combine these elements by known methods with no changes in their respective functions, and the combination yielded nothing more than predictable results of flattening one of many intermediate layers of a semiconductor device.

A person of ordinary skill in the art would have found it trivial to use the CMP process to polish a semiconductor device, including one having one or more layers of Cu, W, an oxide layer, or a combination thereof, at least because semiconductor device manufacturing processes routinely involved fabrication of a semiconductor device including such layers. At minimum, a person of ordinary skill in the art would have found it obvious to try to use a CMP process to polish a semiconductor device, including one having one or more layers of Cu, W, an oxide layer, or a combination thereof. Such a combination would have therefore yielded predictable results of

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flattening one of many intermediate layers of a semiconductor device. Such combination would have yielded predictable results because one skilled in the art would have been able to combine these elements by known methods with no changes in their respective functions, and the combination yielded nothing more than predictable results of flattening one of many intermediate layers of a semiconductor device.

A person of ordinary skill in the art would have also been motivated to use a slurry that includes abrasive particles and an oxidizing agent such as hydrogen peroxide. For example, as disclosed in the Polishing Workpiece References discussed in Section III.E.2, it was well known in the art that such slurries were appropriate for use in CMP processes.

A person of ordinary skill in the art would have been motivated to use such slurries in a CMP process because such combination would have yielded predictable results of etching and/or dissolving, as well as abrading materials as part of the CMP process. A person of ordinary skill in the art would have understood that the functionality of slurries may be performed by a variety of materials/chemicals, including abrasive particles (such as ceria, silica or alumina) and an oxidizing agent such as hydrogen peroxide. A person of ordinary skill in the art would have had a reasonable expectation of success in using slurries with abrasive particles and hydrogen peroxide in the CMP process because in such a combination each element merely performs the same function as it does separately. A person of ordinary skill in the art would have found it trivial to use slurries with abrasive particles (such as ceria, silica or alumina) and hydrogen peroxide in the CMP process. At minimum, it would have been obvious to a person of ordinary skill in the art to try using such a slurry with a reasonable expectation of success, because such slurries were well known in the art and it therefore at most would be a simple substitution of one known element with another.

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iii. Reasons To Combine With Monolayer References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to manufacture a CMP pad dresser with a monolayer of a plurality of superabrasive particles protruding from a matrix layer. For example, as is disclosed in the Monolayer References discussed in Section III.E.3, it was well-known that superabrasive particles in a CMP pad dresser may protrude from a matrix layer—forming a monolayer of superabrasive particles on a rigid support substrate—and extend away from the rigid support substrate.

A person of ordinary skill in the art would have been motivated to provide a matrix layer and a rigid support substrate with a monolayer of superabrasive particles extending from the support. It was well known that it was desirable to place superabrasive particles on a CMP pad dresser firmly such that the superabrasive particles do not fall out during the conditioning process. Accordingly, a POSITA would have been motivated to use a matrix layer to adhere superabrasive particles onto a CMP pad dresser. A POSITA would have also been motivated to use a rigid support substrate to provide structural support to the superabrasive particles.

Moreover, a person of ordinary skill in the art would have been motivated to form a monolayer of superabrasive particles on the matrix layer and rigid support substrate, with each superabrasive particle protruding from the matrix layer and extending away from the rigid support substrate. In the CMP process, the superabrasive particles need to protrude from the matrix layer and extend away from the rigid support in order to dress a CMP pad. Accordingly, a person of ordinary skill in the art would have been motivated to form a monolayer of superabrasive particles where each superabrasive particle extends from the support substrate and protrudes from the matrix layer. A person of ordinary skill in the art would have found it trivial and straightforward, and would have had a reasonable expectation of success, to make and use CMP pad dresser structure

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including a matrix layer, rigid support substrate, and superabrasive particles in order to for the dresser to function as such a configuration was well known. At a minimum, it would have been obvious to try from the finite configurations of a monolayer of superabrasive particles protruding from a matrix layer and extending away from a rigid support.

iv. Reasons To Combine With Protrusion/Profile References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to provide leveled superabrasive particles whose protruding heights are controlled. For example, as is disclosed in the Protrusion/Profile References discussed in Section III.E.4, it was well-known that a CMP pad dresser may be engineered such that protruding heights of superabrasive particles on the rigid support substrate are controlled. It was also well known that the protrusion distances of the superabrasive particles may be controlled such that the differences in their protrusion distances fall within a narrow range. For example, it was well known in the art that the difference in the protrusion distance between the highest and second highest protruding tips may be less than or equal to about 10 microns, or less than or equal to about 50 microns. Similarly, it was well known in the art that the difference in the protrusion distance between the highest 10 protruding tips is less than or equal to about 20 microns; the difference in the protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles is within about 80 microns or less; the difference in the protrusion distance between the highest and 10th highest protruding tips is less than or equal to about 20 microns; and/or the highest protruding tip and the 100th highest protruding tip is less than or equal to about 40 microns. Moreover, it was well-known that the superabrasive particles' tips may be aligned along a designated profile with a tip variation from about 5 to about 100 microns; from about 10 to about 50 microns; from about 20 to 40 microns;

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or less than about 20 microns. A variety of designated profiles were well known as well, such as a plane, a slope, a curved shape, a dome shape, and a combination thereof.

A person of ordinary skill in the art would have been motivated to make CMP pad dressers that have a tip-to-designated profile variation that is small (e.g., so the difference in the protrusion distance between the highest and second highest protruding tips may be less than or equal to about 10 microns, or less than or equal to about 50 microns; the difference in the protrusion distance between the highest 10 protruding tips is less than or equal to about 20 microns; the difference in the protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles is within about 80 microns or less; the difference in the protrusion distance between the highest and 10th highest protruding tips is less than or equal to about 20 microns; and/or the highest protruding tip and the 100th highest protruding tip is less than or equal to about 40 microns; the superabrasive particles' tips may be aligned along a designated profile with a tip variation from about 5 to about 100 microns; from about 10 to about 50 microns; from about 20 to 40 microns; or less than about 20 microns) because it was well-known to a POSITA that CMP pad dressers exhibit desirable characteristics when superabrasive particles are leveled (e.g., uniform dressing of CMP pads, including cutting uniform asperities into CMP pads; even wear on the superabrasive particles; extending the life of the CMP pad dresser; and increasing the number of working superabrasive particles). A person of ordinary skill in the art would have been motivated to make CMP pad dressers with designated profiles along a plane, slope, curved shape, dome shape, and a combination thereof to make CMP pad dressers suitable for different applications.

A person of ordinary skill in the art would have recognized that other tip-to-designated profile variations are acceptable (e.g., so the difference in the protrusion distance between the highest and second highest protruding tips may be less than or equal to about 10 microns, or less

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than or equal to about 50 microns; the difference in the protrusion distance between the highest 10 protruding tips is less than or equal to about 20 microns; the difference in the protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles is within about 80 microns or less; the difference in the protrusion distance between the highest and 10th highest protruding tips is less than or equal to about 20 microns; and/or the highest protruding tip and the 100th highest protruding tip is less than or equal to about 40 microns; the superabrasive particles' tips may be aligned along a designated profile with a tip variation from about 5 to about 100 microns; from about 10 to about 50 microns; from about 20 to 40 microns; or less than about 20 microns), taking into account different considerations such as cost of manufacturing, ease of processing conditions, and the like. As such, a person of ordinary skill in the art would have considered leveling the height of the superabrasive particles to the various levels taught by the prior art to be merely one among some finite number of leveling options to choose from that can be based on well-known ease of fabrication and conditioning performance.

At a minimum, it would have been obvious to try from the finite number of identified tip-to-designated profile variations enumerated in the prior art to achieve predictable solutions.

A person of ordinary skill in the art would have been able to make such CMP pad dressers having a narrow tip variation (e.g., so the difference in the protrusion distance between the highest and second highest protruding tips may be less than or equal to about 10 microns, or less than or equal to about 50 microns; the difference in the protrusion distance between the highest 10 protruding tips is less than or equal to about 20 microns; the difference in the protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particles is within about 80 microns or less; the difference in the protrusion distance between the highest and 10th highest protruding tips is less than or equal to about 20 microns; and/or the highest protruding tip

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and the 100th highest protruding tip is less than or equal to about 40 microns; the superabrasive particles' tips may be aligned along a designated profile with a tip variation from about 5 to about 100 microns; from about 10 to about 50 microns; from about 20 to 40 microns; or less than about 20 microns) with a reasonable expectation of success because the claimed variations and various methods of making CMP pad dressers are well-known in the art. A person of ordinary skill in the art would have been able to make such CMP pad dressers having a planar, a sloped, a curved shaped, a dome shaped, and a combination thereof designated profile with a reasonable expectation of success because each designated profile and various methods of making CMP pad dressers is well known in the prior art.

At a minimum, a person of ordinary skill in the art would have found it obvious to try to combine the disclosures of different tip variations with different CMP pad dresser fabrication methods to achieve a relatively uniform tip variation with a reasonable expectation of success. At a minimum, it would have been obvious to try from the finite number of identified tip-to-designated profile variations enumerated in the prior art to achieve predictable solutions. At a minimum, it would have been obvious to try from the finite geometric configurations of designated profiles.

v. Reasons To Combine With Cutting Depth References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to provide a CMP pad dresser that is rotated against a CMP pad to cut asperities into the CMP pad with various, uniform cutting depths. For example, as is disclosed in the Cutting Depth References discussed in Section III.E.5, it was well-known that rotating a CMP pad dresser against a CMP pad to cut asperities into the CMP pad with various degree of cutting depths. For example, CMP pad dressers having cutting depths of less than about 60 microns or having cutting depth ranges such as less than or equal to

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about 50 microns; about 10 microns to about 50 microns; less than about 20 microns; about 1 micron to about 20 microns; and about 10 microns to about 20 microns were well-known in the art.

A person of ordinary skill in the art would have been motivated to make CMP pad dressers that produce desired cutting depths for use with different CMP pads and different polishing applications. It was well-known in the field that CMP pad dressers are rotating tools that cut asperities into CMP pads, and that cutting asperities into a CMP pad is merely a design choice based on desired pad life and CMP performance. CMP pad dressers having cutting depths of less than about 60 microns or having cutting depth ranges such as less than or equal to about 50 microns; about 10 microns to about 50 microns; less than about 20 microns; about 1 micron to about 20 microns; and about 10 microns to about 20 microns were well-known. Accordingly, a person of ordinary skill in the art would have been motivated to provide CMP pad dressers that cut uniform asperities into CMP pads in order to extend the life of CMP pads, have better control of the CMP process, and facilitate semiconductor fabrication.

A person of ordinary skill in the art would have found it trivial and straightforward, and would have had a reasonable expectation of success, to manufacture CMP pad dressers using known methods that cut asperities into CMP pads to known cutting depths. For example, CMP pad dressers being rotated against a CMP pad and cutting asperities into the CMP pad having cutting depths of less than about 60 microns or having cutting depth ranges such as less than or equal to about 50 microns; about 10 microns to about 50 microns; less than about 20 microns; about 1 micron to about 20 microns; and about 10 microns to about 20 microns were well-known in the art.

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A person of ordinary skill in the art would have readily recognized that the cutting depths taught by the prior art would be achievable in the combination with different CMP pad dresser manufacturing methods taught by the prior art, as they would be expected to dress similar polyurethane CMP pads. All the claimed elements were known in the prior art and one skilled in the art would have been able to combine the elements as claimed by known methods with no change in their respective functions, and the combination yielded nothing more than predictable results to one of ordinary skill in the art. Hence, a person of ordinary skill in the art would have been able to make the combination to achieve the claimed cutting depths of the CMP pads with routine experimentation.

At a minimum, it would have been obvious to try to achieve different cutting depths by rotating the CMP pad dresser against a CMP pad to cut asperities into the CMP pad, because this method and cutting depths of less than about 60 microns or cutting depth ranges such as less than or equal to about 50 microns; about 10 microns to about 50 microns; less than about 20 microns; about 1 micron to about 20 microns; and about 10 microns to about 20 microns were well-known in the art.

vi. Reasons To Combine With Working Particles References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to provide a CMP pad dresser with a high proportion of the superabrasive particles acting as working superabrasive particles and cutting into the CMP pad. For example, as is disclosed the Working Particle References discussed in Section III.E.6, it was well-known that a CMP pad dresser includes working particles or tips that cut asperities into the CMP pad as the dresser is rotated. It was also well known that the number of working particles or the number of tips that cut into the CMP pad may be controlled.

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For example, the number of tips that cut asperities into the CMP pad dresser was well understood to be at least 100, at least 50, or at least 25. Also, the number of working particles was well understood to be at least 100, at least 1000, about 1000 to about 6000, about 2000 to about 5000, at least about 1000. Moreover, it was well known that the CMP pad dresser may include at least about 1000 working particles protruding from the rigid support substrate to distances within about 30 microns of one another.

A person of ordinary skill in the art would have been motivated to make CMP pad dressers with a controlled number of superabrasive particles acting as working superabrasive particles and cutting into the CMP pad. It was well-known in the field that CMP pad dressers with only a small number of working superabrasive particles can lead to poor conditioning performance. Accordingly, a person of ordinary skill in the art would have been motivated to provide CMP pad dressers with a higher proportion of working superabrasive particles that cut into the CMP pad to uniformly dress the CMP pad and in turn, uniformly polish the workpiece. The number of tips that cut asperities into the CMP pad dresser was well understood to be at least 100, at least 50, or at least 25. Also, the number of working particles was well understood to be at least 100, at least 1000, about 1000 to about 6000, about 2000 to about 5000, at least about 1000. Moreover, it was well known that the CMP pad dresser may include at least about 1000 working particles protruding from the rigid support substrate to distances within about 30 microns of one another.

A person of ordinary skill in the art would have found it trivial and straightforward, and would have had a reasonable expectation of success, to manufacture CMP pad dressers with a controlled number of working superabrasive particles that cut into the CMP pad using known superabrasive particle leveling techniques and known CMP pad dresser manufacturing techniques. For example, the number of tips that cut asperities into the CMP pad dresser was well understood

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to be at least 100, at least 50, or at least 25. Also, the number of working particles was well understood to be at least 100, at least 1000, about 1000 to about 6000, about 2000 to about 5000, at least about 1000. Moreover, it was well known that the CMP pad dresser may include at least about 1000 working particles protruding from the rigid support substrate to distances within about 30 microns of one another.

A person of ordinary skill in the art would have readily recognized that the number of working superabrasive particles that cut into the CMP pad taught by the prior art would have been achievable in the combination with different CMP pad dresser manufacturing methods taught by the prior art, as they would be expected to dress similar polyurethane CMP pads. All the claimed elements were known in the prior art and one skilled in the art would have been able to combine the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. Hence, a person of ordinary skill in the art would have been able to make the combination to achieve the claimed number of working superabrasive particles that cut into the CMP pad dresser with routine experimentation.

At a minimum, it would have been obvious to try to control the number of working superabrasive particles that cut asperities into the CMP pad by choosing from the finite number of working superabrasive particles (e.g., at least 100, at least 1000, about 1000 to about 6000, about 2000 to about 5000, at least about 1000) and cutting superabrasive particles (e.g., at least 100, at least 50, or at least 25) disclosed in the art.

vii. Reasons To Combine With Peripheral Location References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to arrange the superabrasive particles

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on the CMP pad dresser only in the peripheral location and/or in a predetermined pattern. For example, as disclosed in the Peripheral Location References discussed in Section III.E.7, it was well known and common to arrange the superabrasive particles in various predetermined patterns and locations, such as to place them only in peripheral location of the dresser.

A person of ordinary skill in the art would have been motivated to provide the superabrasive particles on the CMP pad dresser only in the peripheral location and/or in a predetermined pattern, to meet various conditioning demands. Accordingly, such a combination would amount to nothing more than combining known prior art elements according to known methods to yield predictable results.

A person of ordinary skill in the art would have been motivated to provide the superabrasive particles on the CMP pad dresser only in the peripheral location and/or in a predetermined pattern, because it would have amounted to nothing more than using known techniques to make a similar CMP dresser in the same way with predictable results.

At minimum, it would have been obvious to a person of ordinary skill in the art to try to arrange the superabrasive particles only in a peripheral location and/or in a predetermined pattern to achieve desired dressing characteristics and/or particle retention.

C. Invalidity Under 35 U.S.C. § 112

The Asserted Claims of the ’862 Patent are invalid for failing to satisfy the enablement and written description requirements under 35 U.S.C. § 112, ¶ 1 and/or for indefiniteness under 35 U.S.C. § 112, ¶ 2. Defendants’ contentions are based on their present understanding of the Asserted Claims and in light of Plaintiff’s P.R. 3-1 Infringement Contentions. Defendants reserve the right to supplement, amend, and/or modify these § 112 invalidity contentions in view of additional discovery and claim constructions.

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As noted above, Plaintiff has not yet provided a claim construction for many of the terms and phrases that Defendants anticipate will be in dispute. Defendants, therefore, cannot provide a complete list of their § 112 defenses because Defendants do not know whether Plaintiff will proffer a construction for certain terms and phrases that are broader than, or inconsistent with, the construction that would be supportable by the disclosure set forth in the specification.

To the extent the following contentions reflect constructions of claim limitations consistent with or implicit in Plaintiff's P.R. 3-1 Infringement Contentions, Defendants do not necessarily agree with Plaintiff's claim constructions, and Defendants expressly reserve the right to contest such claim constructions. Defendants offer these contentions in response to Plaintiff's P.R. 3-1 Infringement Contentions and without prejudice to any position they may ultimately take as to any claim construction issues.

Accordingly, Defendants reserve the right to supplement, amend, or modify these P.R. 3-3 Invalidity Contentions as discovery progresses and in response to any changes in Plaintiff's positions.

1. Pre-AIA 35 U.S.C. § 112, ¶ 1: Written Description

The Asserted Claims of the '862 Patent are invalid under pre-AIA § 112, ¶ 1 because the '862 Patent's specification does not provide adequate written description for the subject matter of the Asserted Claims.

For a claim to be valid, the specification must contain "a written description of the invention." 35 U.S.C. § 112, ¶ 1. To fulfill the written description requirement, the patent "must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (alteration in original) (quoting *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1562–63 (Fed. Cir. 1991)). To satisfy that requirement, "the applicant must 'convey with reasonable clarity to those

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skilled in the art that, as of the filing date sought, he or she was in possession of the invention,' and demonstrate that by disclosure in the specification of the patent." *Carnegie Mellon Univ. v. Hoffmann-La Roche Inc.*, 541 F.3d 1115, 1122 (Fed. Cir. 2008) (quoting *Vas-Cath*, 935 F.2d at 1563–64); *see also Ariad*, 598 F.3d at 1351 ("[T]he test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed."); *id.* (noting that "the hallmark of written description is disclosure" and therefore that "'possession as shown in the disclosure' is a more complete formulation" of the inventor's requisite "possession" of the claimed subject matter).

The Asserted Claims are invalid because the specification fails to provide an adequate written description of at least the following limitations:

Claim Limitations	'862 Patent Asserted Claims
"rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns"	All Asserted Claims
"at least 100 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated"	2
"at least 50 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated"	3
"at least 25 tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated"	4
"substantially all of the asperities are cut in the CMP pad by superabrasive particles located at a peripheral location of the dresser"	5
"substantially all of the superabrasive particles are located at a peripheral location of the dresser"	9
"substantially all of the superabrasive particles are arranged in uniform predetermined pattern at a peripheral location of the dresser"	10
"the semiconductor device includes one or more layers of Cu, W, an oxide layer, or a combination thereof"	13
"the semiconductor has a line width of less than or equal to about 30 nm"	15

[redacted]

"the slurry includes an abrasive selected from the group consisting of silica, alumina, ceria, and combinations thereof"	17
"the slurry includes an oxidative compound"	18
"the oxidative compound is hydrogen peroxide"	19
"the CMP pad is polyurethane"	20

The '862 Patent's specification does not adequately describe what "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns" entails. For example, the '862 Patent indicates 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" and that the monolayer can be "leveled such that rotating the dresser against the CMP cuts asperities having a maximum cutting depth of about 60 microns." '862 Patent at 9:33–41. But the '862 Patent does not provide a written description of how a dresser rotates "against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns." Because this limitation is required for every Asserted Claim of the '862 Patent, all Asserted Claims are invalid for failure to comply with the written description requirement under § 112, ¶ 1. The remaining claim limitations are similarly insufficiently described in the specification.

In addition, at least under Plaintiff's apparent contention that the '862 Patent is entitled to a priority date earlier than the filing date, the Asserted Claims of the '862 Patent are also invalid because none of the claim limitations recited in the chart above are disclosed anywhere in the priority documents. *See supra* § II.A.

2. Pre-AIA 35 U.S.C. § 112, ¶ 1: Lack of Enablement

The Asserted Claims of the '862 Patent are invalid under pre-AIA § 112, ¶ 1 because the '862 Patent's specification would not have enabled a POSITA to make and use the same.

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For a claim to be valid, the specification must describe "the manner and process of making and using [the invention], in such full, clear, concise, and exact terms as to enable any person skilled in the art . . . to make and use the" patented invention without "undue experimentation." *Crown Operations Int'l, Ltd. v. Solutia Inc.*, 289 F.3d 1367, 1379 (Fed. Cir. 2002); *see* 35 U.S.C. § 112, ¶ 1. "The specification must contain sufficient disclosure to enable an ordinary skilled artisan to make and use the entire scope of the claimed invention at the time of the filing." *MagSil Corp. v. Hitachi Glob. Storage Techs., Inc.*, 687 F.3d 1377, 1381 (Fed. Cir. 2012) (citation omitted).

To determine whether undue experimentation is needed, several factors are considered including: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. *In re Wands*, 858 F.2d 731, 736–37 (Fed. Cir. 1988).

The Asserted Claims are invalid because the specification fails to provide an enabling disclosure of at least the following limitations:

Claim Limitations	'862 Patent Asserted Claims
"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 10 microns"	All Asserted Claims
"the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles are within about 20 microns or less"	All Asserted Claims
"rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns"	All Asserted Claims
"wherein at least [100/50/25] tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated"	2–4
"for up to about [90/50/33]% of the dresser radius"	6–8

[redacted]

Enablement "prevents both inadequate disclosure of an invention and overbroad claiming that might otherwise attempt to cover more than was actually invented. Thus, a patentee chooses broad claim language at the peril of losing any claim that cannot be enabled across its full scope of coverage." *MagSil*, 687 F.3d at 1381.

The claim limitations "at least [100/50/25] tips of the plurality of superabrasive particles cut asperities into the CMP pad as the dresser is rotated" does not adequately enable a person of ordinary skill in the art to make and use the entire scope of the claimed invention. *See MagSil*, 687 F.3d at 1383–84 (finding "open-ended" claim language such as "by at least 10%" insufficient to satisfy enablement "because it has a lower threshold, but not an upper limit," and the "specification only enables an ordinarily skilled artisan to achieve a small subset" of the overbroad and open-ended claim range). The specification states that "numerical data" presented "in a range format . . . should be interpreted flexibly to include not only the numerical values explicitly recited as the limits of the range, but also to include all the individual numerical values or sub-ranges encompassed within that range as if each numerical value and sub-range is explicitly recited." '862 Patent at 6:41–49. Significantly, the specification indicates that "[t]he same principle applies to ranges reciting only one numerical value as a minimum or maximum" and that "such an interpretation should apply regardless of the breadth of the range or the characteristics being described." *Id.* at 6:56–59. Accordingly, the specification only exacerbates the lack of enablement of this claim limitation. *See MagSil*, 687 F.3d at 1383 ("The open claim language chosen by the inventors does not grant them any forgiveness on the scope of requirement enablement."); *id.* at 1384 ("MagSil's difficulty in enabling the asserted claims is a problem of its own making." (citing *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1380 (Fed. Cir. 2007))).

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The claim limitations "less than or equal to about 10 microns," "within about 20 microns or less," and "for up to about [90/50/33%] of the dresser radius" similarly fail to enable a person of ordinary skill in the art to make and use the full scope of the claimed invention. *See* '869 Patent at 6:29–31 ("[T]he term 'about' is used to provide flexibility to a numerical endpoint by providing that a given value may be 'a little above' or 'a little below' the endpoint."); *see also id.* at 6:56– 59. Because several such limitations are required to satisfy each Asserted Claim, all Asserted Claims of the '862 Patent "are invalid for lack of enablement because their broad scope is not reasonably supported by the scope of the enablement in the specification." *MagSil*, 687 F.3d at 1384.

Further, the claim limitation "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns" does not enable a person of ordinary skill in the art to make and use the full scope of the claimed invention. For example, the specification states "the monolayer" can be "leveled such that rotating the dresser against the CMP pad cuts asperities having a maximum cutting depth of about [80/60/40] microns." '862 Patent at 9:36–44. But the specification does not explain how the monolayer is leveled and instead indicates only 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 9:33–35. As another example, the specification states that "the load placed on the CMP pad by the dresser can affect the morphology of the spacers, such as, in some cases, the asperity depth" and that "[t]he load can be adjusted for a given dresser to adjust penetration depth." *Id.* at 9:63–66. But the specification merely recites several broad (and overlapping) ranges of exemplary loads without indicating the significance of such ranges or whether and how those ranges relate to asperity depth. *See id.* at 9:66–10:3 ("In one aspect, for example, the load can be from about 0.1 Kg to about 60 Kg. In other aspects, the load can be from about 2 Kg to about

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20 Kg. In further aspects, the load may be 6 Kg to 12 Kg."). This is especially problematic since the specification also suggests that the material used may impact the effect of the load placed on the CMP pad dresser. *See, e.g.*, *id.* at 10:4–8 ("[I]n one aspect an 11.5 Kg load can allow a material removal rate from the wafer of about 200 microns per hour for Cu layers. In a related example, an 11.5 Kg load can allow a material removal rate from the wafer of about 100 microns per hour for oxides.").

Identifying various factors that may impact the asperity depth does not, however, enable a skilled artisan to make and use the claimed method of conditioning a CMP pad. *See Genentech Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997) ("Patent protection is granted in return for an enabling disclosure of invention, not for vague intimations of general ideas that may or may not be workable."); *id.* ("[W]hen there is no disclosure of any specific starting material or of any of the conditions under which a process can be carried out, undue experimentation is required; there is a failure to meet the enablement requirement that cannot be rectified by asserting that all the disclosure related to the process is within the skill of the art."); *see also Crown Operations*, 289 F.3d at 1380 ("[T]he novel aspects of the invention must be disclosed and not left to inference, that is, a patentee may not rely on the inference of a person of ordinary skill in the pertinent art to supply such novel aspects."). "Instead, it provides 'only a starting point, a direction for further research.'" *ALZA Corp. v. Andrx Pharms., LLC*, 603 F.3d 936, 943 (Fed. Cir. 2010) (quoting *Auto Tech. Int'l, Inc. v. BMW of N. Am., Inc.*, 501 F.3d 1274, 1284 (Fed. Cir. 2007)) (citing *Genentech*, 108 F.3d at 1366). Because the "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns" limitation is required to satisfy each and every Asserted Claim, all Asserted Claims of the '862 Patent are invalid for lack of enablement.

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The Asserted Claims of the ’862 Patent are accordingly invalid for failure to comply with the enablement requirement under § 112, ¶ 1.

3. Pre-AIA 35 U.S.C. § 112 ¶ 2: Indefiniteness

The Asserted Claims of the ’862 Patent are invalid under pre-AIA § 112, ¶ 2 because the ’862 Patent fails to inform, with reasonable certainty, those skilled in the art about the scope of the claimed invention.

Section 112, ¶ 2 requires the patent specification “conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.” *See Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 789 F.3d 1335, 1340 (Fed. Cir. 2015). “A patent is indefinite ‘if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.’” *Id.* at 1340–41 (quoting *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 910 (2014)). “While a claim employing a ‘term[ ] of degree’ may be definite ‘where it provide[s] enough to certainty to one of skill in the art when read in the context of the invention,’ a term of degree that is ‘purely subjective’ and depends ‘on the unpredictable vagaries of any one person’s opinion’ is indefinite.” *Intell. Ventures I LLC v. T-Mobile USA, Inc.*, 802 F.3d 1372, 1381 (Fed. Cir. 2018) (quoting *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1371 (Fed. Cir. 2014); *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1350–51 (Fed. Cir. 2005)); *see also Cypress Lake Software, Inc. v. Samsung Elecs. Am., Inc.*, 382 F. Supp. 3d 586, 610 (E.D. Tex. 2019) (“It is well established that the meaning of a claim limitation ‘cannot depend on the undefined views of unnamed persons, even if they are experts, specialists, or academics.’” (citation omitted)); *id.* (finding claims including terms “more convenient” and “permits a user to conveniently enter” to be indefinite because “each disputed phrase is ‘highly subjective and, on its face, provides little guidance to one of skill in the art’” (citation omitted)). Furthermore, a claim

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that covers both "an apparatus and method of use of that apparatus" is indefinite. *IPXL Holdings, L.L.C. v. Amazon.com, Inc.*, 430 F.3d 1377, 1384 (Fed. Cir. 2005).

Notably, while it can be ascertained that certain prior art is within the scope of the claims, at least the outer boundaries of the claims are uncertain in view of the above limitations, creating an unacceptable "zone of certainty" such that the claims fail to set forth the scope of the alleged invention with reasonable certainty. *Nautilus*, 572 U.S. at 909–10 (quoting *United Carbon Co. v. Binney & Smith Co.*, 17 U.S. 228, 236 (1942)).

The Asserted Claims are rendered indefinite and therefore invalid because at least the following limitations fail to set forth the scope of the alleged invention with reasonable certainty:

Claim Terms	'862 Patent Asserted Claims
"the difference in protrusion distance between the highest protruding tip and the second highest protruding tip" / "the difference in protrusion distance between the highest 10 protruding tips"	All Asserted Claims
"less than or equal to about 10 microns" / "within about 20 microns or less"	All Asserted Claims
"rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns"	All Asserted Claims
"for up to about [90/50/33]% of the dresser radius	6–8

As one example, "the second highest protruding tip" and "the highest 10 protruding tips" are not reasonably certain because the specification fails to inform those skilled in the art how to measure relative protrusion or height difference and because the point of reference is not clear. For example, the specification vaguely notes that "the term 'protrusion' refers to the height of a particle relative to some reference point," without providing the reference point to make the determination as claimed. *See, e.g.*, '862 Patent at 10:26–32 ("It should be noted that for the purposes of the present disclosure, the term 'protrusion' refers to the height of a particle relative to some reference point . . . such as, for example, the highest particle tip, a surface of a rigid support, the bottom

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surface of the matrix, etc."); *id.* at 10:37–40 ("[A] relative protrusion or height difference between two particles would be the difference in the heights between these particles measured from a common reference point."). Additionally, the term "highest" is not reasonably certain where, as here, the specification does not provide sufficient disclosure of how to determine which protruding tip is "the second highest" and which protruding tips are "the highest 10" when a monolayer of superabrasive particles comprises more than one "highest" protruding tip. For example, if a pad has three particles with heights of 60 microns, 60 microns, and 40 microns, respectively, the specification provides no guidance as to whether "the second highest protruding tip" is the second particle having a height of 60 microns or the particle having the lower height of 40 microns.

Further, the full scope of the claim phrases "the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive particles" and "the difference in protrusion distance between the highest 10 protruding tips of the monolayer of superabrasive particles" are not reasonably certain at least because the specification provides no guidance for the outer boundaries of "difference in protrusion distance." *See, e.g.*, '862 Patent at 8:45–47 ("It is noted that the term 'protrusion difference' can also be used to describe the difference in protraction distance between any two or more super abrasive particles."); *id.* at 9:6–8 ("It is noted that the recited protrusion distances can include a distribution across the entire monolayer surface or a discreate area or segment of the monolayer."). The Asserted Claims are likewise rendered indefinite for failure to provide explicit antecedent basis for "the difference in protrusion distance" limitations. *See* MPEP § 2173.05(e) ("A claim is indefinite when it contains words or phrases whose meaning is unclear." (citing *In re Packard*, 751 F.3d 1307, 1314 (Fed. Cir. 2014))). The scope of "the difference in protrusion distance" language lacks clarity also because "the difference in protrusion distance" limitation recites "the difference in protrusion

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distance between the highest 10 protruding tips of the monolayer of superabrasive particles ***are*** within about 20 microns or less." '862 Patent at 20:20–27.

As another example, the scope of the claim phrase "rotating the dresser against the CMP pad such that asperities are cut into the CMP pad having a maximum cutting depth of about 60 microns" is not reasonably certain at least because the specification fails to provide sufficient guidance or parameters to a person of skill in the art regarding the scope of the "maximum cutting depth" limitation.

Further, the full scope of the claim limitation "wherein the peripheral location extends from an outer edge of the dresser inwardly toward a center point of the dresser for up to about [90/50/33]% of the dresser radius" is not reasonably certain because the specification provides no guidance for the outer boundaries of "up to about [90/50/33]%." Specifically, the specification fails to provide sufficient guidance or parameters to a person of skill in the art for determining the appropriate cutoff for "up to about [90/50/33]% of the dresser radius," where "the term 'about' is used to provide flexibility to a numerical endpoint by providing that a given value may be 'a little above' or 'a little below' the endpoint." '862 Patent at 6:29–31; *see also id.* at 6:41–49, 56– 59 ("It is to be understood that . . . a range format [reciting only one numerical value as a minimum or a maximum] is used merely for convenience and brevity and thus should be interpreted flexibly to include not only the numerical values explicitly recited as the limits of the range, but also to include all the individual numerical values or sub-ranges encompassed within that range as if each numerical value and sub-range is explicitly recited. . . . Furthermore, such an interpretation should apply regardless of the breadth of the range or the characteristics being described."). For example, if the claim recites "up to about 90%," the specification does not make clear whether the cutoff

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should be 89.9%, 90.5%, 91%, or 95%, nor does the specification suggest how a skilled artisan should make that determination.

The above limitations accordingly fail to set forth the scope of the claimed invention with reasonable certainty. Because several such limitations are required to satisfy every Asserted Claim of the '862 Patent, all Asserted Claims are indefinite and therefore invalid under § 112 ¶ 2.

D. Additional Reasons for Invalidity of the '862 Patent

Claims 1–6, 9–12, and 20 of the '862 Patent are anticipated and/or rendered obvious, and claims 5–10, 13, 15, and 17–19 are rendered obvious, by prior art for at least the reasons provided in IPR2024-00534 filed on February 29, 2024, which is herein incorporated by reference in its entirety. *See* SAMSUNG_CMS_002733–SAMSUNG_CMS_004597.

V. INVALIDITY OF THE '802 PATENT

A. Invalidity Due to Anticipation Under 35 U.S.C. § 102

Under the proper priority date of the '802 Patent—i.e., October 3, 2014—the '802 Patent is subject to the AIA provisions of the patent statute.[13]

A claimed invention is anticipated if "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987).

The Asserted Claims of the '802 Patent are invalid under § 102(a)(1) because the claimed subject matter "was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention." 35 U.S.C. § 102(a)(1). The term "on sale" under AIA § 102(a)(1) carries the same meaning as the

[13] If the '802 Patent is found to be entitled to a priority date earlier than March 16, 2013, then the '802 Patent is subject to the pre-AIA provisions of the patent statute, as explained in Section IV.A.

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term "on sale" under pre-AIA § 102(b). *Helsinn Healthcare S.A. v. Teva Pharms. USA, Inc*., 139 S. Ct. 628, 630 (2019).

The Asserted Claims of the '802 Patent are invalid under § 102(a)(2) because the claimed subject matter "was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention." 35 U.S.C. § 102(a)(2).

As detailed in Section II.A above, the Asserted Claims of the '802 Patent is not entitled to a priority date before October 3, 2014. At least under the proper priority date, and subject to the reservation of rights set forth above and based on Defendants' present understanding of the Asserted Claims of the '802 Patent, and the apparent application of claim terms Plaintiff is asserting based on its Infringement Contentions, Defendants contend the following:

- Saesol PA anticipates at least claims 1–21 of the '802 Patent.
- Shinhan PA anticipates at least claims 1–21 of the '802 Patent.
- EHWA PA anticipates at least claims 1–21 of the '802 Patent.
- 3M PA anticipates at least claims 1–21 of the '802 Patent.
- ATI PA anticipates at least claims 1–21 of the '802 Patent.
- Yen anticipates at least claims 1, 4, 5, 8, 9, 12-15, and 19–21 of the '802 Patent.
- Smith anticipates at least claims 1–21 of the '802 Patent.
- Lawing anticipates at least claims 1–5, 13–15, and 19–21 of the '802 Patent.
- Liao anticipates at least claims 1–7 and 13–21 of the '802 Patent.
- Tian anticipates at least claims 1, 5, 8–14, and 19–21 of the '802 Patent.
- Ishizuka anticipates at least claims 1, 5–7, 14, and 16–20 of the '802 Patent.

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- Kinik2008 anticipates at least claims 1–13 and 15–21 of the ’802 Patent.

1. Saesol PA

Exhibit 802-1 contains a claim chart demonstrating that Saesol PA, including 4DNS80AMC1, HLPX-MD08_M (also known as HLPX-DH3661 or LPX-DH3661), EK45_AM13BSL8031C1-PMF_24, and AM32R80C1-MF included each and every element of the Asserted Claims of the ’802 Patent, at least under Plaintiff’s apparent application of its claims. The Saesol PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.1. As shown in Exhibit 802-1, at least under Plaintiff's apparent application of its claims, the Saesol PA included and/or taught all claimed features of the ’802 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “a rigid support substrate” and “a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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.”

2. Shinhan PA

Exhibit 802-2 contains a claim chart demonstrating that Shinhan PA, including PNC01D, 99102, CMP-E-M49-AC, 99561, 99004, 99086, PNC07B, and ARIX-R, included each and every element of the Asserted Claims of the ’802 Patent, at least under Plaintiff’s apparent application of its claims. Shinhan PA was sold, offered for sale, and was known or used by others in this

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country before either the claimed or proper priority date. *See* Section III.C.2. As shown in Exhibit 802-2, at least under Plaintiff's apparent application of its claims, Shinhan PA included and/or taught all claimed features of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

3. EHWA PA

Exhibit 802-3 contains a claim chart demonstrating that EHWA PA, including BSL-CMP (e.g., serial numbers 00315036, [redacted], [redacted]) and CVD-CMP, included each and every element of the Asserted Claims of the '802 Patent, at least under Plaintiff's apparent application of its claims. EHWA PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.3. As shown in Exhibit 802-3, at least under Plaintiff's apparent application of its claims, EHWA PA included and/or taught all claimed features of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, wherein a tip of each of the plurality of superabrasive particles aligns along a designated profile with a tip variation of

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from about 5 microns to about 100 microns, 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, 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."

4. 3M PA

Exhibit 802-4 contains a claim chart demonstrating that 3M PA, including 3M-A160, 3M-2810, 3M-A3700, and 3M-A82, included each and every element of the Asserted Claims of the '802 Patent, at least under Plaintiff's apparent application of its claims. 3M PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.4. As shown in Exhibit 802-4, at least under Plaintiff's apparent application of its claims, 3M PA included and/or taught all claimed features of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

Sung initially alleged in the Complaint that Defendants infringe at least claim 1 of the '802 Patent on the basis that 3M's Diamond CMP Pad Conditioner meets claim 1 of the '802 Patent.

[redacted]

See D.I., 1, ¶59; *id.,* Ex. 9. Accordingly, under at least the apparent constructions in the Complaint, 3M PA anticipates at least claim 1 of the ’802 Patent.

Also, Sung asserts in a co-pending litigation that Texas Instruments Inc. (“TI”) infringes the Asserted Claims of the ’802 Patent on the basis that TI uses 3M Diamond CMP Pad Conditioners. *See* TI MSJ. Accordingly, under at least the Plaintiff’s apparent constructions in its infringement contentions in the TI Action (which is incorporated by reference herein), 3M PA invalidates the Asserted Claims of the ’802 Patent.

5. ATI PA

Exhibit 802-5 contains a claim chart demonstrating that ATI PA, including ATI-Infinity II and ATI-Infinity Ver. 6.1, included each and every element of the Asserted Claims of the ’802 Patent, at least under Plaintiff’s apparent application of its claims. ATI PA was sold, offered for sale, and was known or used by others in this country before either the claimed or proper priority date. *See* Section III.C.5. As shown in Exhibit 802-5, at least under Plaintiff's apparent application of its claims, ATI PA included and/or taught all claimed features of the ’802 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “a rigid support substrate” and “a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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.”

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Also, Sung initially alleged in the Complaint that Defendants infringe at least claim 1 of the '802 Patent on the basis that ATI-Infinity II meets claim 1 of the '802 Patent. *See* D.I., 1, ¶59; *id.,* Ex. 12. Accordingly, under at least the apparent constructions in the Complaint, ATI PA anticipates at least claim 1 of the '802 Patent.

6. Yen

Exhibit 802-6 contains a claim chart demonstrating that Yen discloses each and every element of claims 1, 4, 5, 8, 9, 12–15, and 19–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Yen was filed on January 14, 2008 and published on February 12, 2009, which is before the proper priority date. *See* Exhibit 802-6, cover. As shown in Exhibit 802-6, at least under Plaintiff's apparent application of its claims, Yen discloses all claimed features of at least claims 1, 4, 5, 8, 9, 12–15, and 19–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

7. Smith

Exhibit 802-7 contains a claim chart demonstrating that Smith discloses each and every element of claims 1–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Smith was filed on March 6, 2012 and published on September 13, 2012, which is before

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the proper priority date. *See* Exhibit 802-7, cover. As shown in Exhibit 802-7, at least under Plaintiff's apparent application of its claims, Smith discloses all claimed features of at least claims 1–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

8. Lawing

Exhibit 802-8 contains a claim chart demonstrating that Lawing discloses each and every element of claims 1–5, 13–15, and 19–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Lawing was filed on June 1, 2001 and published on December 5, 2002, which is before the claimed priority date. *See* Exhibit 802-8, cover. As shown in Exhibit 802-8, at least under Plaintiff's apparent application of its claims, Lawing discloses all claimed features of at least claims 1–5, 13–15, and 19–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 wherein the difference in protrusion

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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, 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."

9. Liao

Exhibit 802-9 contains a claim chart demonstrating that Liao discloses each and every element of claims 1–7 and 13–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Liao was published on February 15, 2004, which is before the claimed priority date. *See* Exhibit 802-9, cover. As shown in Exhibit 802-9, at least under Plaintiff's apparent application of its claims, Liao discloses all claimed features of at least claims 1–7 and 13–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

10. Tian

Exhibit 802-10 contains a claim chart demonstrating that Tian discloses each and every element of claims 1, 5, 8–14, and 19–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Tian was filed on June 2, 2005, which is before the claimed priority date. *See* Exhibit 802-10, cover. As shown in Exhibit 802-10, at least under Plaintiff's apparent

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application of its claims, Tian discloses all claimed features of at least claims 1, 5, 8–14, and 19–21 of the ’802 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “a rigid support substrate” and “a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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.”

11. Ishizuka

Exhibit 802-11 contains a claim chart demonstrating that Ishizuka discloses each and every element of claims 1, 5–7, 14, and 16-20 of the ’802 Patent, at least under Plaintiff’s apparent application of its claims. Ishizuka was published on November 5, 2007, which is before the proper priority date. *See* Exhibit 802-11, cover. As shown in Exhibit 802-11, at least under Plaintiff's apparent application of its claims, Ishizuka discloses all claimed features of at least claims 1, 5–7, 14, and 16–20 of the ’802 Patent, at least under Plaintiff’s apparent application of its claims, including, for example, “a rigid support substrate” and “a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 wherein the difference in protrusion distance between the highest protruding tip and the second highest protruding tip of the monolayer of superabrasive

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particles is less than or equal to about 50 microns, 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."

12. Kinik2008

Exhibit 802-12 contains a claim chart demonstrating that Kinik2008 discloses each and every element of claims 1–13 and 15–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims. Kinik2008 was published on October 1, 2008, which is before the proper priority date. *See* Exhibit 802-12, cover. As shown in Exhibit 802-12, at least under Plaintiff's apparent application of its claims, Kinik2008 discloses all claimed features of at least claims 1–13 and 15–21 of the '802 Patent, at least under Plaintiff's apparent application of its claims, including, for example, "a rigid support substrate" and "a monolayer of a plurality of superabrasive particles coupled to the support substrate, wherein each superabrasive particle in the monolayer extends away from the support substrate to a protrusion distance, 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 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, 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."

B. Invalidity Due to Obviousness Under 35 U.S.C. § 103

To the extent that any one of the Asserted Claims of the '802 Patent is not anticipated pursuant to § 102 by any particular prior art reference listed in Section V.A, any purported differences are such that the claimed subject matter as a whole would have been obvious to one skilled in the art at the time of the alleged invention, in view of the state of the art and knowledge

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of those skilled in the art under § 103. The Asserted Claims contain nothing that goes beyond ordinary design and implementation; no Asserted Claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those skilled in the art.

Specifically, Defendants contend that the Asserted Claims of the '802 Patent would have been obvious in view of the prior art combinations identified below for the'802 Patent in Section V.B.2. In addition to the combinations of prior art and the combinations of groups of prior art disclosed in Section V.B.2, Defendants further reserve the right to rely on any other combinations of any prior art references disclosed herein or references that become known to Defendants after serving Plaintiff with these Invalidity Contentions. Defendants further reserve the right to rely upon combinations disclosed within the prosecution histories of the references cited herein. These obviousness combinations reflect Defendants' present understanding of the potential scope of the Asserted Claims that Plaintiff appears to be advocating and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the Asserted Claims.

Those of ordinary skill in the art at the time of the alleged inventions of the Asserted Patents would have been motivated to modify or combine the prior art references as set forth in Section V.B.2 because, *inter alia*: (a) the references in general deal with the same or analogous subject matter of CMP pad dressers and conditioning CMP pads; (b) a POSITA would have been motivated by the problem that the inventor was attempting to solve, or with other problems that would have been faced in reaching a solution, and would have looked to references that concerned similar issues or taught how to overcome the problems faced; (c) the combinations were obvious to try and would have operated in their known and expected way; (d) the combinations were within the technical skill and understanding of a POSITA; (e) the combinations would have been

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motivated by the developments in technology; (f) the combinations reflect various design choices that would have been known to a POSITA and within that person's technical capability to implement (i.e., technically feasible); (g) a POSITA of the Asserted Patents would have been motivated to incorporate the benefits into the methods or systems described in the prior art, including to improve various mechanical, structural, durability, and functioning of CMP pad dressers and conditioning CMP pads.

To be clear, Defendants' contentions regarding obviousness are provided in the alternative to any contentions of anticipation and are not to be understood to suggest that any reference is not itself anticipatory. Further, Defendants' contentions reflect Defendants' present understanding of the potential scope of the claims that Plaintiff appears to be advancing and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the Asserted Claims.

1. Invalidity Due To Obviousness

In general, a claimed invention is invalid due to obviousness "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103; *Graham v. John Deere Co.*, 383 U.S. 1, 13 (1966). The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: "(1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the art at the time of invention; and (4) objective evidence of nonobviousness." *Miles Labs., Inc. v. Shandon, Inc.*, 997 F.2d 870, 877 (Fed. Cir. 1993) (citing *Graham*, 383 U.S. at 17-18). The Supreme Court's decision in *KSR Int'l Co. v. Teleflex Inc.* reaffirmed *Graham*, but further held that a claimed invention can be obvious even if there is no explicit teaching, suggestion, or motivation for combining the prior art to produce that invention. 550 U.S. 398, 414–18 (2007).

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To determine whether there is a reason to combine the known elements in the manner claimed by a patent, a court can "look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art." *KSR*, 550 U.S. at 418. For example, obviousness can be demonstrated by showing "there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *Id*. at 420. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id*. Common sense also teaches that "familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*.

Indeed, in assessing obviousness of claims, the Court can consider the inferences and creative steps a person of ordinary skill in the art would employ in combining prior art teachings. *See KSR*, 550 U.S. at 418 ("[A] court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ."). Defendants hereby expressly incorporate by reference any statements and reasons set forth by the examiner during prosecution of the Asserted Patents and related patent applications as to why it would have been obvious to modify or combine references to achieve the limitations of the Asserted Claims. Defendants further contend that the prior art identified in these Invalidity Contentions is evidence of simultaneous or near-simultaneous independent invention by others of the alleged inventions recited in one or more of the Asserted Claims. Defendants reserve the right to rely on the simultaneous or near-simultaneous independent invention by others as further evidence of the obviousness of the Asserted Claims. And as previously discussed, Defendants assert that Plaintiff is not entitled to its claimed priority

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dates for the Asserted Claims of the Asserted Patents. Therefore, Defendants further reserve the right to modify their anticipation and/or obviousness arguments to include additional prior art based on the Court's determination of the proper priority dates of the Asserted Patents.

The references disclosed herein and in the attached charts provide specific motivation to combine prior art. As reflected herein, in the attached Exhibits, and in the references themselves, there was a reason to make each combination—each combination of art would have produced no unexpected results, and each combination at most would simply represent a known alternative to one of ordinary skill in the art. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 414–18 (2007) (rejecting the Federal Circuit's "rigid" application of the teaching, suggestion, or motivation-to-combine test, instead espousing an "expansive and flexible" approach). "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 416. Similarly, "[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one," *id.* at 417, and thus "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id*. Indeed, the Supreme Court has held that a person of ordinary skill is "a person of creativity, not an automaton" and "in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id*. at 420–21. The Federal Circuit reaffirmed the Supreme Court's rejection of a "rigid approach to determining obviousness" and explained the importance of recognizing the state of the art and "critical background information" relevant to the obviousness analysis. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362–63 (Fed. Cir. 2013).

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The obviousness combinations identified below reflect Defendants' present understanding of the potential scope of the claims that Plaintiff appears to be advancing and should not be construed as Defendants' acquiescence to Plaintiff's interpretation of the patent claims. To be clear, nothing in the Invalidity Contentions shall be treated as an admission that the accused technology meets any limitations of the Asserted Claims. Defendants deny that they infringe any claim of the Asserted Claims. Nothing stated herein shall be construed as an admission or a waiver of any particular construction of any claim term. Defendants expressly reserve the right to contest any claim construction asserted by Plaintiff and expressly reserves all noninfringement arguments.

2. The '802 Patent Is Obvious Over Numerous Combinations Of Prior Art References

Prior art references rendering the Asserted Claims of the '802 Patent obvious, alone or in combination with other references, are identified and discussed below and are included in the claim charts Exhibits 802-1 through 802-13. Exhibits 802-1 through 802-13 include exemplary claim charts for the '802 Patent showing specific combinations of references, including citations to where in the references the teachings, suggestions, and motivations to combine the references are disclosed. Further reasons to combine the references identified in Exhibits 802-1 through 802-13 include the nature of the problem being solved, the express, implied and inherent teachings of the prior art, the knowledge of persons of ordinary skill in the art, that such combinations would have yielded predictable results, and that such combinations would have represented known alternatives to a person of ordinary skill in the art.

The references cited in Defendants' exemplary claim charts, Exhibits 802-1 through 802-12, are Saesol PA, Shinhan PA, EHWA PA, 3M PA, ATI PA, Yen, Smith, Lawing, Liao, Tian, Ishizuka, and Kinik2008. Each of the references in Exhibits 802-1 through 802-12 discloses and/or suggests all or, at a minimum, the vast majority of the limitations of the Asserted Claims of the

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’802 Patent. To the extent any claim elements are found to be missing from a particular reference analyzed in Exhibits 802-1 through 802-12, the claim element would have been rendered obvious by the particular reference in combination with other references analyzed in Exhibits 802-1 through 802-12 and/or with references identified and described in Sections III.E.3 (Pad Dressers with a Monolayer), III.E.4 (Protrusion Distances and Profile), III.E.5 (Cutting CMP Pads), III.E.6 (Number of Working Particles), and III.E.7 (Placement of Particles).

Specifically, subject to the reservation of rights above and based at least on Defendants’ present understanding of the Asserted Claims of the ’802 Patent and Plaintiff’s apparent application of its Asserted Claims, the following Asserted Claims of the ’802 Patent are rendered obvious by the specified combinations of references. For example, each of the references identified in V.A can be combined with any one or more of the specific references identified in Sections III.E.3 through III.E.7 and V.A, and the combinations are not limited solely to those identified below. These specified combinations of references are meant to be illustrative only and are not meant to be limited to only the exemplary combinations explicitly noted below. Moreover, the specific combinations provided herein are not meant to specify which is a primary reference or a secondary reference. In other words, any of the references identified in the specific combinations provided herein may be used as a primary and/or secondary reference.

- Claims 1–21 are obvious over Saesol PA.
- Claims 1–21 are obvious over Saesol PA and Protrusion/Profile Reference(s).
- Claims 1–21 are obvious over Saesol PA and Cutting Depth Reference(s).
- Claims 1–21 are obvious over Saesol PA and Working Particles Reference(s).
- Claims 1–21 are obvious over Saesol PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s).

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- Claims 1–21 are obvious over Saesol PA and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Saesol PA and Protrusion/Profile Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Saesol PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Shinhan PA.
- Claims 1–21 are obvious over Shinhan PA and Protrusion/Profile Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Cutting Depth Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Working Particles Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Protrusion/Profile Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Shinhan PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over EHWA PA.
- Claims 1–21 are obvious over EHWA PA and Protrusion/Profile Reference(s).
- Claims 1–21 are obvious over EHWA PA and Cutting Depth Reference(s).
- Claims 1–21 are obvious over EHWA PA and Working Particles Reference(s).

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- Claims 1–21 are obvious over EHWA PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s).
- Claims 1–21 are obvious over EHWA PA and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over EHWA PA and Protrusion/Profile Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over EHWA PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 20–21 are obvious over EHWA PA and Peripheral Location Reference(s).
- Claims 20–21 are obvious over EHWA PA and Protrusion/Profile Reference(s) and Peripheral Location Reference(s).
- Claims 1–5, 15, and 19 are obvious over 3M PA.
- Claims 6–8 and 16–18 are obvious over 3M PA and Cutting Depth Reference(s).
- Claims 8–12 are obvious over 3M PA and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 13–15 and 19 are obvious over 3M PA and Protrusion/Profile Reference(s).
- Claims 20–21 are obvious over 3M PA and Peripheral Location Reference(s).
- Claims 1–5, 13–15, and 19 are obvious over 3M PA and Protrusion/Profile Reference(s).
- Claims 6–8 and 16–18 are obvious over 3M PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s).
- Claims 8–12 are obvious over 3M PA and Protrusion/Profile Reference(s) and Cutting Depth Reference(s) and Working Particles Reference(s).

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- Claims 20–21 are obvious over 3M PA and Protrusion/Profile Reference(s) and Peripheral Location Reference(s).
- Claims 1–5, 13–4, and 19 are obvious over ATI PA.
- Claims 6–8 and 16–18 are obvious over ATI PA and Cutting Depth Reference(s).
- Claim 15 is obvious over ATI PA and Protrusion/Profile Reference(s).
- Claims 20–21 are obvious over ATI PA and Peripheral Location Reference(s).
- Claims 8–12 are obvious over ATI PA and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–5, 8, 9, and 12–21 are obvious over Yen.
- Claims 2–3 are obvious over Yen and Protrusion/Profile Reference(s).
- Claims 6–9, 12, and 16–18 are obvious over Yen and Cutting Depth Reference(s).
- Claims 10–11 are obvious over Yen and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1–21 are obvious over Smith.
- Claims 1–21 are obvious over Smith and Monolayer Reference(s).
- Claims 1–21 are obvious over Smith and Monolayer Reference(s).
- Claims 1–21 are obvious over Smith and Cutting Depth Reference(s).
- Claims 1–21 are obvious over Smith and Monolayer Reference(s) and Cutting Depth Reference(s).
- Claims 1–5, 13–15, and 19–21 are obvious over Lawing.
- Claims 6–7 and 16–18 are obvious over Lawing and Cutting Depth Reference(s).
- Claims 8–12 are obvious over Lawing and Cutting Depth Reference(s) and Working Particles Reference(s).

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- Claims 1–7 and 13–21 are obvious over Liao.
- Claims 8–12 are obvious over Liao and Working Particles Reference(s).
- Claims 1–7 and 13–21 are obvious over Liao and Monolayer Reference(s).
- Claims 8–12 are obvious over Liao and Monolayer Reference(s) and Working Particles Reference(s).
- Claims 6–7 are obvious over Liao and Cutting Depth Reference(s).
- Claims 8–12 are obvious over Liao and Cutting Depth Reference(s) and Working Particles Reference(s).
- Claims 1, 5, 13–14, and 19–21 are obvious over Tian.
- Claims 2–4 and 14–15 are obvious over Tian and Protrusion/Profile Reference(s).
- Claims 6–12 and 16–18 are obvious over Tian and Cutting Depth Reference(s).
- Claims 1–7 and 13–21 are obvious over Tian and Monolayer Reference(s).
- Claims 2–4 and 14–15 are obvious over Tian and Monolayer Reference(s) and Protrusion/Profile Reference(s).
- Claims 6–12 and 16–18 are obvious over Tian and Monolayer Reference(s) and Cutting Depth Reference(s).
- Claims 1–7, 14, and 16–20 are obvious over Ishizuka.
- Claims 13–15 are obvious over Ishizuka and Protrusion/Profile Reference(s).
- Claims 8–12 are obvious over Ishizuka and Working Particle Reference(s).
- Claim 21 is obvious over Ishizuka and Peripheral Location Reference(s).
- Claims 13–15 are obvious over Ishizuka and Monolayer Reference(s) and Protrusion/Profile Reference(s).

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- Claims 8–12 are obvious over Ishizuka and Monolayer Reference(s) and Working Particle Reference(s).
- Claim 21 is obvious over Ishizuka and Monolayer Reference(s) and Peripheral Location Reference(s).
- Claims 6–7 and 16–18 are obvious over Ishizuka and Cutting Depth Reference(s).
- Claims 8–12 are obvious over Ishizuka and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 6–7 and 16–18 are obvious over Ishizuka and Monolayer Reference(s) and Cutting Depth Reference(s).
- Claims 8–12 are obvious over Ishizuka and Monolayer Reference(s) and Cutting Depth Reference(s) and Working Particle Reference(s).
- Claims 1–21 are obvious over Kinik2008.
- Claims 1–21 are obvious over Kinik2008 and Monolayer Reference(s).
- Claims 2–3 and 14–15 are obvious over Kinik2008 and Protrusion Profile Reference(s).
- Claims 2–3 and 14–15 are obvious over Kinik2008 and Monolayer Reference(s) and Protrusion Profile Reference(s).
- Claims 8–12 are obvious over Kinik2008 and Working Particles Reference(s).
- Claims 8–12 are obvious over Kinik2008 and Monolayer Reference(s) and Working Particles Reference(s).

More specifically, and subject to the reservations provided above, the following Asserted Claims of the ’802 Patent are rendered obvious by the exemplary references alone or with combinations of references provided below. These exemplary combinations of references are

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meant to be illustrative only and are not meant to be limiting in any way. For example, each of the references in Section V.A can be combined with any one of the references identified in Sections in Sections III.E.1 through III.E.7, V.A, V.D and in Exhibits 802-1 to 802-13.

'802 Patent, Claims 1–21

- Product PA alone (i.e., any one of Saesol PA, Shinhan PA, EHWA PA, 3M PA, or ATI PA)
- Product PA and Smith
- Product PA and Yen
- Product PA and Kinik869
- Product PA and Liao
- Product PA and Kinik2008
- Product PA and CMPUG2009
- Product PA and Smith and Yen
- Product PA and Smith and Kinik869
- Product PA and Smith and Liao
- Product PA and Smith and Kinik2008
- Product PA and Smith and CMPUG2009
- Product PA and Yen and Kinik869
- Product PA and Yen and Liao
- Product PA and Yen and Kinik2008
- Product PA and Yen and CMPUG2009
- Product PA and Kinik869 and Liao
- Product PA and Kinik869 and Kinik2008

[redacted]

- Product PA and Kinik869 and CMPUG2009
- Product PA and Liao and Kinik2008
- Product PA and Liao and CMPUG2009
- Product PA and Kinik2008 and CMPUG2009
- Product PA and Smith and Yen and Kinik869
- Product PA and Smith and Yen and Liao
- Product PA and Smith and Yen and Kinik2008
- Product PA and Smith and Yen and CMPUG2009
- Product PA and Yen and Kinik869 and Liao
- Product PA and Yen and Kinik869 and Kinik2008
- Product PA and Yen and Kinik869 and CMPUG2009
- Product PA and Kinik869 and Liao and Kinik2008
- Product PA and Kinik869 and Liao and CMPUG2009
- Product PA and Liao and Kinik2008 and CMPUG2009
- Product PA and Smith and Yen and Kinik869 and Liao
- Product PA and Smith and Yen and Kinik869 and Kinik2008
- Product PA and Smith and Yen and Kinik869 and CMPUG2009
- Product PA and Yen andKinik869 and Liao and Kinik2008
- Product PA and Yen and Kinik869 and Liao and CMPUG2009
- Product PA and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Product PA and Smith and Yen and Kinik869 and Liao and Kinik2008
- Product PA and Smith and Yen and Kinik869 and Liao and CMPUG2009
- Product PA and Yen and Kinik869 and Liao and Kinik2008 and CMPUG2009

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- Product PA and Smith and Yen and Kinik869 and Liao and Kinik2008 and CMPUG2009

’802 Patent, Claims 1, 5 and 19–20

- Yen alone
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Lawing alone
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Yen and Kinik869
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869

[redacted]

- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Lawing and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869

’802 Patent, Claims 2–4

- Yen alone
- Yen and Smith
- Yen and Kinik869
- Yen and Smith and Kinik869
- Smith alone

[redacted]

- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Lawing alone
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Yen and Kinik869
- Tian and Kinik298 and Smith
- Tian and Lawing and Smith
- Tian and Kinik869 and Smith
- Tian and Kinik298 and Lawing and Smith
- Tian and Kinik298 and Kinik869 and Smith
- Tian and Kinik298 and Yen
- Tian and Lawing and Yen
- Tian and Kinik869 and Yen
- Tian and Kinik298 and Lawing and Yen
- Tian and Kinik298 and Kinik869 and Yen

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- Tian and Lawing and Kinik869 and Yen
- Tian and Kinik298 and Kinik869
- Tian and Lawing and Kinik869
- Tian and Kinik298 and Lawing and Kinik869
- Tian and Kinik298 and Smith and Yen
- Tian and Lawing and Smith and Yen
- Tian and Kinik869 and Smith and Yen
- Tian and Kinik298 and Lawing and Smith and Yen
- Tian and Kinik298 and Kinik869 and Smith and Yen
- Tian and Lawing and Smith and Kinik869
- Tian and Kinik298 and Lawing and Smith and Kinik869
- Tian and Lawing and Smith and Yen and Kinik869
- Tian and Kinik298 and Lawing and Smith and Yen and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869
- Kinik2008 alone
- Kinik2008 and
- Kinik2008 and Kinik298

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[redacted]

- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Smith
- Kinik2008 and Yen
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Kinik298 and Smith
- Kinik2008 and Kinik298 and Yen
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and Smith
- Kinik2008 and Lawing and Yen
- Kinik2008 and Kinik869 and Smith
- Kinik2008 and Kinik869 and Yen
- Kinik2008 and Smith and Yen
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Smith
- Kinik2008 and Kinik298 and Lawing and Yen
- Kinik2008 and Kinik298 and Kinik869 and Smith
- Kinik2008 and Kinik298 and Kinik869 and Yen
- Kinik2008 and Kinik298 and Smith and Yen
- Kinik2008 and Lawing and Kinik869 and Smith
- Kinik2008 and Lawing and Kinik869 and Yen
- Kinik2008 and Kinik869 and Smith and Yen

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[redacted]

- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Yen
- Kinik2008 and Lawing and Kinik869 and Smith and Yen
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith and Yen

’802 Patent, Claims 6–7

- Yen alone
- Yen and Liao
- Yen and Kinik2008
- Yen and Kinik869
- Yen and Liao and Kinik2008
- Yen and Liao and Kinik869
- Yen and Kinik2008 and Kinik869
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Liao
- Smith and Kinik2008
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Kinik298 and Liao
- Smith and Kinik298 and Kinik2008
- Smith and Lawing and Kinik869

[redacted]

- Smith and Lawing and Liao
- Smith and Lawing and Kinik2008
- Smith and Kinik869 and Liao
- Smith and Kinik869 and Kinik2008
- Smith and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869
- Smith and Kinik298 and Lawing and Liao
- Smith and Kinik298 and Lawing and Kinik2008
- Smith and Kinik298 and Kinik869 and Liao
- Smith and Kinik298 and Kinik869 and Kinik2008
- Smith and Kinik298 and Liao and Kinik2008
- Smith and Lawing and Kinik869 and Liao
- Smith and Lawing and Kinik869 and Kinik2008
- Smith and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao
- Smith and Kinik298 and Lawing and Kinik869 and Kinik2008
- Smith and Lawing and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Lawing alone
- Lawing and Liao
- Lawing and Kinik2008
- Lawing and Kinik869
- Lawing and Liao and Kinik2008

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[redacted]

- Lawing and Liao and Kinik869
- Lawing and Kinik2008 and Kinik869
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Kinik2008
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Smith and Kinik2008
- Liao and Yen and Kinik869
- Liao and Yen and Kinik2008
- Liao and Kinik869 and Kinik2008
- Liao and Smith and Yen and Kinik869
- Liao and Smith and Yen and Kinik2008
- Liao and Smith and Kinik869 and Kinik2008
- Liao and Yen and Kinik869 and Kinik2008
- Liao and Smith and Yen and Kinik869 and Kinik2008
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Liao

[redacted]

- Tian and Kinik2008
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Kinik298 and Liao
- Tian and Kinik298 and Kinik2008
- Tian and Lawing and Kinik869
- Tian and Lawing and Liao
- Tian and Lawing and Kinik2008
- Tian and Kinik869 and Liao
- Tian and Kinik869 and Kinik2008
- Tian and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869
- Tian and Kinik298 and Lawing and Liao
- Tian and Kinik298 and Lawing and Kinik2008
- Tian and Kinik298 and Kinik869 and Liao
- Tian and Kinik298 and Kinik869 and Kinik2008
- Tian and Kinik298 and Liao and Kinik2008
- Tian and Lawing and Kinik869 and Liao
- Tian and Lawing and Kinik869 and Kinik2008
- Tian and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao
- Tian and Kinik298 and Lawing and Kinik869 and Kinik2008
- Tian and Lawing and Kinik869 and Liao and Kinik2008

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[redacted]

- Tian and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Liao and Kinik2008

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- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869

’802 Patent, Claims 8–9 and 12

- Yen alone
- Yen and Liao
- Yen and Kinik2008
- Yen and Kinik869
- Yen and CMPUG2009
- Yen and Liao and Kinik2008
- Yen and Liao and Kinik869
- Yen and Kinik2008 and Kinik869

[redacted]

- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Liao
- Smith and Kinik2008
- Smith and CMPUG2009
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Kinik298 and Liao
- Smith and Kinik298 and Kinik2008
- Smith and Lawing and Kinik869
- Smith and Lawing and Liao
- Smith and Lawing and Kinik2008
- Smith and Kinik869 and Liao
- Smith and Kinik869 and Kinik2008
- Smith and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869
- Smith and Kinik298 and Lawing and Liao
- Smith and Kinik298 and Lawing and Kinik2008
- Smith and Kinik298 and Kinik869 and Liao
- Smith and Kinik298 and Kinik869 and Kinik2008
- Smith and Kinik298 and Liao and Kinik2008

[redacted]

- Smith and Lawing and Kinik869 and Liao
- Smith and Lawing and Kinik869 and Kinik2008
- Smith and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao
- Smith and Kinik298 and Lawing and Kinik869 and Kinik2008
- Smith and Lawing and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Lawing alone
- Lawing and Liao
- Lawing and Kinik2008
- Lawing and Kinik869
- Lawing and Smith
- Lawing and CMPUG2009
- Lawing and Liao and Kinik2008
- Lawing and Liao and Kinik869
- Lawing and Liao and Smith
- Lawing and Liao and CMPUG2009
- Lawing and Kinik2008 and Kinik869
- Lawing and Kinik2008 and Smith
- Lawing and Kinik2008 and CMPUG2009
- Lawing and Kinik869 and Smith
- Lawing and Kinik869 and CMPUG2009
- Lawing and Smith and CMPUG2009

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SUNG Exhibit 2007

[redacted]

- Lawing and Liao and Kinik2008 and Kinik869
- Lawing and Liao and Kinik2008 and Smith
- Lawing and Liao and Kinik2008 and CMPUG2009
- Lawing and Liao and Kinik869 and Smith
- Lawing and Liao and Kinik869 and CMPUG2009
- Lawing and Liao and Smith and CMPUG2009
- Lawing and Kinik2008 and Kinik869 and Smith
- Lawing and Kinik2008 and Kinik869 and CMPUG2009
- Lawing and Kinik869 and Smith and CMPUG2009
- Lawing and Liao and Kinik2008 and Kinik869 and Smith
- Lawing and Liao and Kinik2008 and Kinik869 and CMPUG2009
- Lawing and Kinik2008 and Kinik869 and Smith and CMPUG2009
- Lawing and Liao and Kinik2008 and Kinik869 and Smith and CMPUG2009
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Kinik2008
- Liao and CMPUG2009
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Smith and Kinik2008
- Liao and Smith and CMPUG2009
- Liao and Yen and Kinik869

[redacted]

- Liao and Yen and Kinik2008
- Liao and Yen and CMPUG2009
- Liao and Kinik869 and Kinik2008
- Liao and Kinik869 and CMPUG2009
- Liao and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869
- Liao and Smith and Yen and Kinik2008
- Liao and Smith and Yen and CMPUG2009
- Liao and Smith and Kinik869 and Kinik2008
- Liao and Smith and Kinik869 and CMPUG2009
- Liao and Smith and Kinik2008 and CMPUG2009
- Liao and Yen and Kinik869 and Kinik2008
- Liao and Yen and Kinik869 and CMPUG2009
- Liao and Kinik869 and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869 and Kinik2008
- Liao and Smith and Yen and Kinik869 and CMPUG200
- Liao and Yen and Kinik869 and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869 and Kinik2008 and CMPUG2009
- Tian alone
- Tian and CMPUG2009
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869

[redacted]

- Tian and Liao
- Tian and Kinik2008
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Kinik298 and Liao
- Tian and Kinik298 and Kinik2008
- Tian and Lawing and Kinik869
- Tian and Lawing and Liao
- Tian and Lawing and Kinik2008
- Tian and Kinik869 and Liao
- Tian and Kinik869 and Kinik2008
- Tian and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869
- Tian and Kinik298 and Lawing and Liao
- Tian and Kinik298 and Lawing and Kinik2008
- Tian and Kinik298 and Kinik869 and Liao
- Tian and Kinik298 and Kinik869 and Kinik2008
- Tian and Kinik298 and Liao and Kinik2008
- Tian and Lawing and Kinik869 and Liao
- Tian and Lawing and Kinik869 and Kinik2008
- Tian and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao
- Tian and Kinik298 and Lawing and Kinik869 and Kinik2008

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[redacted]

- Tian and Lawing and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and Smith
- Ishizuka and CMPUG2009
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Kinik298 and Smith
- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and Smith
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and Kinik2008
- Ishizuka and Liao and Smith
- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik2008 and Smith
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Smith and CMPUG2009

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- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Smith
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik869 and Liao and Smith
- Ishizuka and Kinik869 and Liao and CMPUG2009
- Ishizuka and Liao and Kinik2008 and Smith
- Ishizuka and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Liao and Smith
- Ishizuka and Kinik298 and Kinik869 and Liao and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008 and Smith
- Ishizuka and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Liao and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and Smith
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and Smith and CMPUG2009
- Kinik2008 alone
- Kinik2008 and Kinik298

[redacted]

- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Smith
- Kinik2008 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Kinik298 and Smith
- Kinik2008 and Kinik298 and CMPUG2009
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and Smith
- Kinik2008 and Lawing and CMPUG2009
- Kinik2008 and Kinik869 and Smith
- Kinik2008 and Kinik869 and CMPUG2009
- Kinik2008 and Smith and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Smith
- Kinik2008 and Kinik298 and Lawing and CMPUG2009
- Kinik2008 and Kinik298 and Kinik869 and Smith
- Kinik2008 and Kinik298 and Kinik869 and CMPUG2009
- Kinik2008 and Kinik298 and Smith and CMPUG2009
- Kinik2008 and Lawing and Kinik869 and Smith
- Kinik2008 and Lawing and Kinik869 and CMPUG2009
- Kinik2008 and Kinik869 and Smith and CMPUG2009

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- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith
- Kinik2008 and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Kinik2008 and Lawing and Kinik869 and Smith and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith and CMPUG2009

’802 Patent, Claims 10–11

- Yen and Liao
- Yen and Kinik2008
- Yen and Kinik869
- Yen and Smith
- Yen and CMPUG2009
- Yen and Liao and Kinik2008
- Yen and Liao and Kinik869
- Yen and Liao and Smith
- Yen and Liao and CMPUG2009
- Yen and Kinik2008 and Kinik869
- Yen and Kinik2008 and Smith
- Yen and Kinik2008 and CMPUG2009
- Yen and Kinik869 and Smith
- Yen and Kinik869 and CMPUG2009
- Yen and Smith and CMPUG2009
- Yen and Liao and Kinik2008 and Kinik869
- Yen and Liao and Kinik2008 and Smith
- Yen and Liao and Kinik2008 and CMPUG2009

[redacted]

- Yen and Liao and Kinik869 and Smith
- Yen and Liao and Kinik869 and CMPUG2009
- Yen and Liao and Smith and CMPUG2009
- Yen and Kinik2008 and Kinik869 and Smith
- Yen and Kinik2008 and Kinik869 and CMPUG2009
- Yen and Kinik869 and Smith and CMPUG2009
- Yen and Liao and Kinik2008 and Kinik869 and Smith
- Yen and Liao and Kinik2008 and Kinik869 and CMPUG2009
- Yen and Kinik2008 and Kinik869 and Smith and CMPUG2009
- Yen and Liao and Kinik2008 and Kinik869 and Smith and CMPUG2009
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Liao
- Smith and Kinik2008
- Smith and CMPUG2009
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Kinik298 and Liao
- Smith and Kinik298 and Kinik2008
- Smith and Lawing and Kinik869
- Smith and Lawing and Liao

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- Smith and Lawing and Kinik2008
- Smith and Kinik869 and Liao
- Smith and Kinik869 and Kinik2008
- Smith and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869
- Smith and Kinik298 and Lawing and Liao
- Smith and Kinik298 and Lawing and Kinik2008
- Smith and Kinik298 and Kinik869 and Liao
- Smith and Kinik298 and Kinik869 and Kinik2008
- Smith and Kinik298 and Liao and Kinik2008
- Smith and Lawing and Kinik869 and Liao
- Smith and Lawing and Kinik869 and Kinik2008
- Smith and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao
- Smith and Kinik298 Lawing and Kinik869 Kinik2008
- Smith and Lawing and Kinik869 and Liao and Kinik2008
- Smith and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Lawing alone
- Lawing and Liao
- Lawing and Kinik2008
- Lawing and Kinik869
- Lawing and Smith
- Lawing and CMPUG2009

[redacted]

- Lawing and Liao and Kinik2008
- Lawing and Liao and Kinik869
- Lawing and Liao and Smith
- Lawing and Liao and CMPUG2009
- Lawing and Kinik2008 and Kinik869
- Lawing and Kinik2008 and Smith
- Lawing and Kinik2008 and CMPUG2009
- Lawing and Kinik869 and Smith
- Lawing and Kinik869 and CMPUG2009
- Lawing and Smith and CMPUG2009
- Lawing and Liao and Kinik2008 and Kinik869
- Lawing and Liao and Kinik2008 and Smith
- Lawing and Liao and Kinik2008 and CMPUG2009
- Lawing and Liao and Kinik869 and Smith
- Lawing and Liao and Kinik869 and CMPUG2009
- Lawing and Liao and Smith and CMPUG2009
- Lawing and Kinik2008 and Kinik869 and Smith
- Lawing and Kinik2008 and Kinik869 and CMPUG2009
- Lawing and Kinik869 and Smith and CMPUG2009
- Lawing and Liao and Kinik2008 and Kinik869 and Smith
- Lawing and Liao and Kinik2008 and Kinik869 and CMPUG2009
- Lawing and Kinik2008 and Kinik869 and Smith and CMPUG2009
- Lawing and Liao and Kinik2008 and Kinik869 and Smith and CMPUG2009

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- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Kinik2008
- Liao and CMPUG2009
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Smith and Kinik2008
- Liao and Smith and CMPUG2009
- Liao and Yen and Kinik869
- Liao and Yen and Kinik2008
- Liao and Yen and CMPUG2009
- Liao and Kinik869 and Kinik2008
- Liao and Kinik869 and CMPUG2009
- Liao and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869
- Liao and Smith and Yen and Kinik2008
- Liao and Smith and Yen and CMPUG2009
- Liao and Smith and Kinik869 and Kinik2008
- Liao and Smith and Kinik869 and CMPUG2009
- Liao and Smith and Kinik2008 and CMPUG2009
- Liao and Yen and Kinik869 and Kinik2008
- Liao and Yen and Kinik869 and CMPUG2009

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[redacted]

- Liao and Kinik869 and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869 and Kinik2008
- Liao and Smith and Yen and Kinik869 and CMPUG200
- Liao and Yen and Kinik869 and Kinik2008 and CMPUG2009
- Liao and Smith and Yen and Kinik869 and Kinik2008 and CMPUG2009
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Liao
- Tian and Kinik2008
- Tian and CMPUG2009
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Kinik298 and Liao
- Tian and Kinik298 and Kinik2008
- Tian and Lawing and Kinik869
- Tian and Lawing and Liao
- Tian and Lawing and Kinik2008
- Tian and Kinik869 and Liao
- Tian and Kinik869 and Kinik2008
- Tian and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869

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[redacted]

- Tian and Kinik298 and Lawing and Liao
- Tian and Kinik298 and Lawing and Kinik2008
- Tian and Kinik298 and Kinik869 and Liao
- Tian and Kinik298 and Kinik869 and Kinik2008
- Tian and Kinik298 and Liao and Kinik2008
- Tian and Lawing and Kinik869 and Liao
- Tian and Lawing and Kinik869 and Kinik2008
- Tian and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao
- Tian and Kinik298 and Lawing and Kinik869 and Kinik2008
- Tian and Lawing and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and Smith
- Ishizuka and CMPUG2009
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Kinik298 and Smith
- Ishizuka and Kinik298 and CMPUG2009

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[redacted]

- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and Smith
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Liao and Kinik2008
- Ishizuka and Liao and Smith
- Ishizuka and Liao and CMPUG2009
- Ishizuka and Kinik2008 and Smith
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Smith
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik869 and Liao and Smith
- Ishizuka and Kinik869 and Liao and CMPUG2009
- Ishizuka and Liao and Kinik2008 and Smith
- Ishizuka and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Liao and Smith
- Ishizuka and Kinik298 and Kinik869 and Liao and CMPUG2009

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[redacted]

- Ishizuka and Kinik869 and Liao and Kinik2008 and Smith
- Ishizuka and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Liao and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and Smith
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and CMPUG2009
- Ishizuka and Kinik869 and Liao and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Liao and Kinik2008 and Smith and CMPUG2009
- Ishizuka and Kinik2008 alone
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Smith
- Kinik2008 and CMPUG2009
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Kinik298 and Smith
- Kinik2008 and Kinik298 and CMPUG2009
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and Smith
- Kinik2008 and Lawing and CMPUG2009
- Kinik2008 and Kinik869 and Smith

[redacted]

- Kinik2008 and Kinik869 and CMPUG2009
- Kinik2008 and Smith and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Smith
- Kinik2008 and Kinik298 and Lawing and CMPUG2009
- Kinik2008 and Kinik298 and Kinik869 and Smith
- Kinik2008 and Kinik298 and Kinik869 and CMPUG2009
- Kinik2008 and Kinik298 and Smith and CMPUG2009
- Kinik2008 and Lawing and Kinik869 and Smith
- Kinik2008 and Lawing and Kinik869 and CMPUG2009
- Kinik2008 and Kinik869 and Smith and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith
- Kinik2008 and Kinik298 and Lawing and Kinik869 and CMPUG2009
- Kinik2008 and Lawing and Kinik869 and Smith and CMPUG2009
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith and CMPUG2009

’802 Patent, Claim 13

- Yen alone
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869

[redacted]

- Smith and Lawing and Kinik869
- Lawing alone
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Yen and Kinik869
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Lawing and Kinik869
- Ishizuka and Kinik298 and Smith
- Ishizuka and Lawing and Smith
- Ishizuka and Kinik869 and Smith
- Ishizuka and Kinik298 and Lawing and Smith
- Ishizuka and Kinik298 and Kinik869 and Smith
- Ishizuka and Kinik298 and Yen
- Ishizuka and Lawing and Yen

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[redacted]

- Ishizuka and Kinik869 and Yen
- Ishizuka and Kinik298 and Lawing and Yen
- Ishizuka and Kinik298 and Kinik869 and Yen
- Ishizuka and Lawing and Kinik869 and Yen
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Smith and Yen
- Ishizuka and Lawing and Smith and Yen
- Ishizuka and Kinik869 and Smith and Yen
- Ishizuka and Kinik298 and Lawing and Smith and Yen
- Ishizuka and Kinik298 and Kinik869 and Smith and Yen
- Ishizuka and Lawing and Smith and Kinik869
- Ishizuka and Kinik298 and Lawing and Smith and Kinik869
- Ishizuka and Lawing and Smith and Yen and Kinik869
- Ishizuka and Kinik298 and Lawing and Smith and Yen and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869

[redacted]

- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869

’802 Patent, Claims 14–15

- Yen alone
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Lawing alone
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Smith and Kinik869

[redacted]

- Liao and Yen and Kinik869
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Lawing and Kinik869
- Ishizuka and Kinik298 and Smith
- Ishizuka and Lawing and Smith
- Ishizuka and Kinik869 and Smith
- Ishizuka and Kinik298 and Lawing and Smith
- Ishizuka and Kinik298 and Kinik869 and Smith
- Ishizuka and Kinik298 and Yen
- Ishizuka and Lawing and Yen
- Ishizuka and Kinik869 and Yen
- Ishizuka and Kinik298 and Lawing and Yen
- Ishizuka and Kinik298 and Kinik869 and Yen
- Ishizuka and Lawing and Kinik869 and Yen
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Smith and Yen

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- Ishizuka and Lawing and Smith and Yen
- Ishizuka and Kinik869 and Smith and Yen
- Ishizuka and Kinik298 and Lawing and Smith and Yen
- Ishizuka and Kinik298 and Kinik869 and Smith and Yen
- Ishizuka and Lawing and Smith and Kinik869
- Ishizuka and Kinik298 and Lawing and Smith and Kinik869
- Ishizuka and Lawing and Smith and Yen and Kinik869
- Ishizuka and Kinik298 and Lawing and Smith and Yen and Kinik869
- Ishizuka alone
- Ishizuka and Kinik298
- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Lawing and Kinik869
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Smith
- Kinik2008 and Yen
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869

[redacted]

- Kinik2008 and Kinik298 and Smith
- Kinik2008 and Kinik298 and Yen
- Kinik2008 and Lawing and Kinik869
- Kinik2008 and Lawing and Smith
- Kinik2008 and Lawing and Yen
- Kinik2008 and Kinik869 and Smith
- Kinik2008 and Kinik869 and Yen
- Kinik2008 and Smith and Yen
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Smith
- Kinik2008 and Kinik298 and Lawing and Yen
- Kinik2008 and Kinik298 and Kinik869 and Smith
- Kinik2008 and Kinik298 and Kinik869 and Yen
- Kinik2008 and Kinik298 and Smith and Yen
- Kinik2008 and Lawing and Kinik869 and Smith
- Kinik2008 and Lawing and Kinik869 and Yen
- Kinik2008 and Kinik869 and Smith Yen
- Kinik2008 and Kinik298 and Lawing and Kinik869
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Yen
- Kinik2008 and Lawing and Kinik869 and Smith and Yen
- Kinik2008 and Kinik298 and Lawing and Kinik869 and Smith and Yen

’802 Patent, Claims 16–18

- Yen and Liao

[redacted]

- Yen and Kinik2008
- Yen and Kinik869
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Smith and Liao
- Smith and Kinik298 and Liao
- Smith and Lawing and Liao
- Smith and Kinik869 and Liao
- Smith and Kinik298 and Lawing and Liao
- Smith and Kinik298 and Kinik869 and Liao
- Smith and Lawing and Kinik869 and Liao
- Smith and Kinik2008
- Smith and Kinik298 and Kinik2008
- Smith and Lawing and Kinik2008
- Smith and Kinik869 and Kinik2008
- Smith and Kinik298 and Lawing and Kinik2008
- Smith and Kinik298 and Kinik869 and Kinik2008
- Smith and Lawing and Kinik869 and Kinik2008

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[redacted]

- Smith and Kinik869
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Smith and Kinik869
- Smith and Kinik298 and Lawing and Kinik869
- Smith and Lawing and Kinik869
- Lawing and Liao
- Lawing and Kinik2008
- Lawing and Kinik869
- Liao alone
- Liao and Smith
- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Yen and Kinik869
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Liao
- Tian and Kinik2008
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869

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[redacted]

- Tian and Kinik298 and Liao
- Tian and Kinik298 and Kinik2008
- Tian and Lawing and Kinik869
- Tian and Lawing and Liao
- Tian and Lawing and Kinik2008
- Tian and Kinik869 and Liao
- Tian and Kinik869 and Kinik2008
- Tian and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869
- Tian and Kinik298 and Lawing and Liao
- Tian and Kinik298 and Lawing and Kinik2008
- Tian and Kinik298 and Kinik869 and Liao
- Tian and Kinik298 and Kinik869 and Kinik2008
- Tian and Kinik298 and Liao and Kinik2008
- Tian and Lawing and Kinik869 and Liao
- Tian and Lawing and Kinik869 and Kinik2008
- Tian and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao
- Tian and Kinik298 and Lawing and Kinik869 and Kinik2008
- Tian and Lawing and Kinik869 and Liao and Kinik2008
- Tian and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka alone
- Ishizuka and Kinik298

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[redacted]

- Ishizuka and Lawing
- Ishizuka and Kinik869
- Ishizuka and Liao
- Ishizuka and Kinik2008
- Ishizuka and Kinik298 and Lawing
- Ishizuka and Kinik298 and Kinik869
- Ishizuka and Kinik298 and Liao
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Lawing and Kinik869
- Ishizuka and Lawing and Liao
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Kinik869 and Liao
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869
- Ishizuka and Kinik298 and Lawing and Liao
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Liao
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Liao and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and Liao and Kinik2008

[redacted]

- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao
- Ishizuka and Kinik298 and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and Liao and Kinik2008
- Ishizuka and Kinik298 and Lawing and Kinik869 and Liao and Kinik2008
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869

’802 Patent, Claim 21

- Yen alone
- Smith alone
- Smith and Kinik298
- Smith and Lawing
- Smith and Kinik869
- Smith and Kinik298 and Lawing
- Smith and Kinik298 and Kinik869
- Smith and Lawing and Kinik869
- Lawing alone
- Liao alone
- Liao and Smith

[redacted]

- Liao and Yen
- Liao and Kinik869
- Liao and Smith and Yen
- Liao and Smith and Kinik869
- Liao and Yen and Kinik869
- Tian alone
- Tian and Kinik298
- Tian and Lawing
- Tian and Kinik869
- Tian and Kinik298 and Lawing
- Tian and Kinik298 and Kinik869
- Tian and Lawing and Kinik869
- Ishizuka and Smith
- Ishizuka and Kinik2008
- Ishizuka and CMPUG2009
- Ishizuka and Smith and Kinik2008
- Ishizuka and Smith and CMPUG2009
- Ishizuka and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Smith
- Ishizuka and Kinik298 and Kinik2008
- Ishizuka and Kinik298 and CMPUG2009
- Ishizuka and Kinik298 and Smith and Kinik2008
- Ishizuka and Kinik298 and Smith and CMPUG2009

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- Ishizuka and Kinik298 and Kinin2008 and CMPUG2009
- Ishizuka and Lawing and Smith
- Ishizuka and Lawing and Kinik2008
- Ishizuka and Lawing and Smith and Kinik2008
- Ishizuka and Lawing and Smith and CMPUG2009
- Ishizuka and Lawing and Kinik2008 and CMPUG2009
- Ishizuka and Kinik869 and Smith
- Ishizuka and Kinik869 and Kinik2008
- Ishizuka and Kinik869 and CMPUG2009
- Ishizuka and Kinik869 and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Smith
- Ishizuka and Kinik298 and Lawing and Kinik2008
- Ishizuka and Kinik298 and Lawing and CMPUG2009
- Ishizuka and Kinik298 and Lawing and Kinik2008 and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Smith
- Ishizuka and Kinik298 and Kinik869 and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and CMPUG2009
- Ishizuka and Kinik298 and Kinik869 and Smith and Kinik2008
- Ishizuka and Kinik298 and Kinik869 and Kinik2008 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Smith
- Ishizuka and Lawing and Kinik869 and Kinik2008
- Ishizuka and Lawing and Kinik869 and CMPUG2009
- Ishizuka and Lawing and Kinik869 and Smith and Kinik2008

[redacted]

- Ishizuka and Lawing and Kinik869 and Smith and CMPUG2009
- Kinik2008 alone
- Kinik2008 and Kinik298
- Kinik2008 and Lawing
- Kinik2008 and Kinik869
- Kinik2008 and Kinik298 and Lawing
- Kinik2008 and Kinik298 and Kinik869
- Kinik2008 and Lawing and Kinik869

To the extent a finder of fact finds that a limitation of a given claim was not disclosed by one of the references identified above, those claims are nevertheless unpatentable as obvious because the asserted claims contain nothing that goes beyond ordinary creativity. To the extent not anticipated, no asserted claim goes beyond combining known elements to achieve predictable results or does more than choose between clear alternatives known to those of ordinary skill in the art, particularly in view of the state of the art as reflected in the relevant references listed above in Sections III.E.3 (Pad Dressers with a Monolayer), III.E.4 (Protrusion Distances and Profile), III.E.5 (Cutting CMP Pads), III.E.6 (Number of Working Particles), and III.E.7 (Placement of Particles).

a. Reasons For Modifications And/Or Combinations

The alleged invention of the ’802 Patent is similar to the ’862 Patent discussed above and essentially implements well-known prior art CMP pad dressers and CMP pads to improve various mechanical, structural, durability, and functioning of CMP pad dressers and the conditioning of CMP pads that are documented by numerous prior art sources.

[redacted]

Applying the principles of obviousness described in Section V.A, it would have been obvious to a person of ordinary skill in the art at the time of the priority date of the ’802 Patent to combine, modify, or use the teachings of the prior art to make the purported inventions of those patents, including by making each of the combinations identified above. The motivation to combine the teachings of the prior art references disclosed herein can be found in each of (1) the references themselves, (2) the nature of the problem being solved, (3) the express, implied and inherent teachings of the prior art, (4) the knowledge of persons of ordinary skill in the art, (5) the fact that the prior art is generally directed towards the subject matter of each respective asserted patent, and (6) the predictable results obtained in combining the elements of the prior art.

Any reference or combination of references that anticipates or makes obvious an asserted independent claim also makes obvious any asserted claim dependent on that independent claim because every element of each dependent claim was known by a person of ordinary skill at the time of the alleged invention, and it would have been obvious to combine those known elements with the independent claim at least as a matter of common sense and routine development.

Numerous prior art references, including those identified above and in the Exhibits, reflect common knowledge and the state of the prior art before the priority date of the ’802 Patent. Because it would be unduly burdensome to create detailed claim charts for the many invalidating combinations, Defendants have provided illustrative examples of such invalidating combinations herein and in Exhibits 802-1 through 802-13. For at least the reasons described in the examples provided, as well as in the attached claim charts, it would have been obvious to one of ordinary skill in the art to combine any of a number of prior art references, including any combination of those identified in Exhibits 802-1 through 802-13, to meet the limitations of the asserted claims.

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As such, Defendants' identification of exemplary combinations is without limitation to Defendants identifying other invalidating combinations as appropriate.

Given the benefits of improving the mechanical, structural, durability, and functioning of CMP pad dressers and the conditioning of CMP pads, a person of ordinary skill in the art at the time of the purported invention would have been motivated to combine the teachings of the structure, tip variation, protrusion distance, heights of particles, pattern of particles of the CMP pad dressers of the prior art references in Defendants' claim charts to develop a CMP pad dresser that meets the Asserted Claims of the '802 Patent. Therefore, to the extent not anticipated fully by any single given reference, it would have been obvious to one skilled in the art to combine features of various mechanical and structural properties of CMP pad dressers.

i. Reasons To Combine With Monolayer References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to make or use CMP pad dressers with a monolayer of superabrasive particles coupled to a rigid support substrate and extending away from the rigid support substrate for at least the reasons provided above in Section IV.B.2.a.iii.

ii. Reasons To Combine With Protrusion/Profile References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to engineer CMP pad dressers to control or obtain desired protruding heights of superabrasive particles for at least the reasons provided above in Section IV.B.2.a.iv. A person of ordinary skill in the art would have found it obvious to engineer CMP pad dressers to achieve tips aligned along a designated profile with a controlled or desired tip variation using a variety of designated profiles such as a plane, a slope, a

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curved shape, a dome shape, and a combination thereof for at least the reasons provided above in Section IV.B.2.a.iv.

iii. Reasons To Combine With Cutting Depth References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to rotate the CMP pad dressers against CMP pads to achieve asperities with various cutting depth as desired for at least the reasons provided above in Section IV.B.2.a.v.

iv. Reasons To Combine With Working Particles References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to use CMP pad dressers in that the number of working particles or the number of tips that cut into CMP pads fall within various desired ranges (and where the working particles protrude from the rigid support substrate within a desired distance such as 3 microns from one another) for at least the reasons provided above in Section IV.B.2.a.vi.

v. Reasons To Combine With Peripheral Location References

Under at least the apparent construction based on Plaintiff's Infringement Contentions, a person of ordinary skill in the art would have found it obvious to make or use CMP pad dressers having superabrasive particle located at a peripheral location and with predetermined patterns (such as a uniform pattern, for example, with a spacing from about 100 to about 800 microns) for at least the reasons provided above in Section IV.B.2.a.vii.

C. Invalidity Under 35 U.S.C. § 112

The Asserted Claims of the '802 Patent are invalid for failing to satisfy the enablement and written description requirements and/or for indefiniteness under § 112. Defendants' contentions

[redacted]

are based on their present understanding of the Asserted Claims and in light of Plaintiff's P.R. 3-1 Infringement Contentions. Defendants reserve the right to supplement, amend, and modify these § 112 invalidity contentions in view of additional discovery and claim constructions.

As noted above, Plaintiff has not yet provided a claim construction for many of the terms and phrases that Defendants anticipate will be in dispute. Defendants, therefore, cannot provide a complete list of their § 112 defenses because Defendants do not know whether Plaintiff will proffer a construction for certain terms and phrases that are broader than, or inconsistent with, the construction that would be supportable by the disclosure set forth in the specification.

To the extent the following contentions reflect constructions of claim limitations consistent with or implicit in Plaintiff's P.R. 3-1 Infringement Contentions, Defendants do not necessarily agree with Plaintiff's claim constructions, and Defendants expressly reserve the right to contest such claim constructions. Defendants offer these contentions in response to Plaintiff's P.R. 3-1 Infringement Contentions and without prejudice to any position they may ultimately take as to any claim construction issues.

Accordingly, Defendants reserve the right to supplement, amend, or modify these P.R. 3-3 Invalidity Contentions as discovery progresses and in response to any changes in Plaintiff's positions.

1. AIA § 112(a): Written Description

The Asserted Claims of the '802 Patent are invalid under pre-AIA § 112 ¶ 1 or AIA § 112(a) because the '802 Patent's specification does not provide adequate written description of the Asserted Claims.

For a claim to be valid, the specification must contain "a written description of the invention." Pre-AIA § 112 ¶ 1; AIA § 112(a). To fulfill the written description requirement, the patent "must clearly allow persons of ordinary skill in the art to recognize that [the inventor]

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invented what is claimed." *Ariad*, 598 F.3d at 1351 (alteration in original) (quoting *Vas-Cath Inc.*, 935 F.2d at 1562–63). To satisfy that requirement, "the applicant must 'convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention,' and demonstrate that by disclosure in the specification of the patent." *Carnegie Mellon Univ.*, 541 F.3d at 1122 (quoting *Vas-Cath*, 935 F.2d at 1563–64); *see also Ariad*, 598 F.3d at 1351 ("[T]he test requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed."); *id.* (noting that "the hallmark of written description is disclosure" and therefore that "'possession as shown in the disclosure' is a more complete formulation" of the inventor's requisite "possession" of the claimed subject matter).

The Asserted Claims are invalid because the specification fails to provide an adequate written description of at least the following limitations:

Claim Terms	'802 Patent Asserted Claims
"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"	6
"the cutting depth is from about 10 microns to about 50 microns"	7
"the plurality of working superabrasive particles includes at least 1000 working superabrasive particles"	9
"the plurality of working superabrasive particles includes from about 1000 to about 6000 working superabrasive particles"	10
"the plurality of working superabrasive particles includes from about 2000 to about 5000 working superabrasive particles"	11
"the plurality of working superabrasive particles include at least about 1000 working superabrasive particles that protrude from the rigid support substrate to distances within about 30 microns of one another"	12

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The ’802 Patent’s specification does not adequately describe what “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” entails. For example, the ’802 Patent indicates 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” and that the monolayer can be “leveled such that rotating the dresser against the CMP cuts asperities having a maximum cutting depth of about 60 microns” in one aspect and “about 40 microns” “[i]n yet another aspect.” ’802 Patent at 15:30–41. But the ’802 Patent does not provide a written description of how a dresser rotates against the CMP pad such that asperities are cut into the CMP pad “having a cutting depth of less than or equal to about 50 microns.” Because this limitation is required for each Asserted Claim recited above, all Asserted Claims are invalid for failure to comply with the written description requirement under § 112. The remaining claim limitations are similarly insufficiently described in the specification.

At least under Plaintiff’s apparent contention that the ’802 Patent is entitled to a priority date earlier than the filing date, the Asserted Claims of the ’802 Patent are invalid because none of the claim limitations recited in the chart above are disclosed anywhere in the priority documents. *See supra* § II.B. Accordingly, the Asserted Claims of the ’802 Patent are invalid for failure to comply with the written description requirement under Section 112.

2. AIA § 112(a): Lack of Enablement

The Asserted Claims of the ’802 Patent are invalid under pre-AIA § 112, ¶ 1 or AIA § 112(a) because the ’802 Patent’s specification would not have enabled a POSITA to make and use the same.

For a claim to be valid, the specification must describe “the manner and process of making and using [the invention], in such full, clear, concise, and exact terms as to enable any person skilled in the art . . . to make and use the” patented invention. Pre-AIA § 112 ¶ 1; AIA § 112(a).

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"[T]he specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation." *Baxalta Inc. v. Genentech, Inc.*, 81 F.4th 1362, 1365 (Fed. Cir. 2023) (quoting *MagSil*, 687 F.3d at 1380); *see also Amgen Inc. v. Sanofi*, 598 U.S. 594, 610 (2023) ("[T]he specification must enable the full scope of the invention as defined by its claims."). "[W]hen a range is claimed, there must be reasonable enablement of the scope of the range." *Amgen Inc. v. Sanofi*, 987 F.3d 1080, 1085 (Fed. Cir. 2021) (quoting *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 959 F.3d 1091, 1100 (Fed. Cir. 2020)), *aff'd* 598 U.S. 594 (2023).

"While functional claim limitations are not necessarily precluded in claims that meet the enablement requirement, such limitations pose high hurdles in fulfilling the enablement requirement for claims with broad functional language." *Amgen*, 987 F.3d at 1087. Notably, "[w]hat emerges from [Federal Circuit] case law is that the enablement inquiry for claims that include functional requirements can be particularly focused on the breadth of those requirements, especially where predictability and guidance fall short." *Id.* at 1086. Specifically, "it is important to consider the quantity of experimentation that would be required to make and use, not only the limited number of embodiments that the patent discloses, but also the full scope of the claim." *Id.*; *see also McRO*, 959 F.3d at 1100 (noting the *Wands* analysis has routinely involved concreate identification of at least some embodiment or embodiments asserted not to be enabled—including what particular products or processes are or may be within the claim, so that breadth is shown concretely and not just as an abstract possibility").

The Asserted Claims are invalid because the specifications fail to provide an enabling disclosure of at least the following limitations:

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Claim Terms	'802 Patent Asserted Claims
"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"	All Asserted Claims
"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"	All Asserted Claims
"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"	Asserted Claims
"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"	2–3
"the difference in protrusion distance between the highest protruding tip and the [10th/100th] highest protruding tip is less than or equal to about [20/40] microns"	4–5
"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"	6
"the highest protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of from about [10/20] microns to about [50/40] microns"	13–14
"the highest 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"	15
"the protrusions of the plurality of superabrasive particles produce cutting depths of from about [1/10] micron[s] to about 20 microns when used to abrade a CMP pad"	17–18

The claim limitation "a tip of the plurality of superabrasive particles aligns along a designated profile with a tip variation of from about 5 microns to about 100 microns" does not teach a person of ordinary skill in the art how to make and use the claimed invention because the disclosure does not inform the skilled artisan how to achieve the "tip variation of from about 5 micron to about 100 microns" by aligning the tips of the superabrasive particles along a designated profile. *See, e.g.*, '802 Patent at 12:55–67 (noting that "any predetermined height that would be useful in an abrading or cutting tool would be considered to be within the presently claimed scope"

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without identifying any factors for determining which predetermined heights are useful). Indeed, the specification acknowledges that "[w]hile it is intended that the tips of the superabrasive particles align along a designated profile, some level of deviation may occur" as "a result of the design or manufacturing process of the tool." *Id.* at 11:35–39; *see also id.* at 17:13–15. The specification further points out that "[g]iven the wide variety of sizes of superabrasive particles that may be potentially utilized in a given tool, such deviations may be highly dependent on a particular application." *Id.* at 11:39–42. Despite those deviations, the specification does not inform the skilled artisan how to achieve the claimed ranges for tip variation.

The claim limitations "the highest protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of from about [10/20] microns to about [50/40] microns" and "the highest 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" likewise fail to enable a skilled artisan to make and use the full scope of the claimed invention.

In addition, the "difference in protrusion distance between the highest protruding tip and the [second/10th/100th] highest protruding tip" and the "difference in protrusion distance between the highest 1% of the protruding tips of the monolayer of superabrasive particle" limitations also fail to enable a person of ordinary skill in the art to make and use the full scope of the claimed invention. The specification ambiguously states that "various methods can be utilized to measure superabrasive particle tip height to determine the difference in protrusion between tips" and, thus, "any method for making such a determination is considered to be within the present scope." '802 Patent at 16:20–24. But that does not teach one of ordinary skill in the art how to achieve the "protrusion distance" limitations or otherwise inform the skilled artisan how to determine the measure the height difference in order to ascertain the protrusion distance.

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This is exacerbated by the fact that "there may be some height deviation between superabrasive particles that occur due to limitations inherent in the manufacturing process," *id.* at 17:13–15, and in view of the many different ways that the specification defines the protrusion distance. *See, e.g.*, *id.* at 16:24–26 (noting that "for the purposes of the present disclosure, the term 'protrusion' refers to the height of a particle relative to some reference point"); *id.* at 11:24–29 (noting that "the actual distribution of protrusion distances across the plurality of superabrasive particles in a finished dresser can be compared against the designed profile to determine the variance, or degree of 'leveling' achieved"); *id.* at 12:18–22 ("In another aspect, each of the plurality of superabrasive particles can be defined by a protrusion distance from an exposed surface of a binding material from which they protrude to a predetermined height[,] [t]hough the predetermined heigh may vary between tool applications . . . ."); *id.* at 14:31–34 ("The difference in protrusion distance between the highest protruding tip and the next highest protruding tip of the monolayer of super abrasive materials is described as the protrusion difference."); *id.* at 14:38–41 ("It is noted that the term 'protrusion difference' can also be used to describe the difference in protrusion distance between any two or more superabrasive particles."); *id.* at 15:1–3 ("It is noted that the recited protrusion distances can include a distribution across the entire monolayer surface or a discrete area or segment of the monolayer.").

Further, the claim limitation "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" or "from about 10 microns to about 50 microns" does not enable a person of ordinary skill in the art to make and use the full scope of the claimed invention because the disclosure fails to teach one of ordinary skill in the art how to achieve the claimed cutting depth ranges. Instead, it provides "only a starting

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point, a direction for further research." *See ALZA*, 603 F.3d at 942 (citations omitted). For example, the specification states that "the monolayer" can be "leveled such that rotating the dresser against the CMP cuts asperities having a maximum cutting depth of about [80/60/40] microns." '802 Patent at 15:33–41. But the specification does not explain how the monolayer is leveled and instead indicates only 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." '802 Patent at 15:30–32. As another example, the specification states that "the load placed on the CMP pad by the dresser can affect the morphology of the spacers, such as, in some cases, the asperity depth" and that "[t]he load can be adjusted for a given dresser to adjust penetration depth." *Id.* at 15:60–63. But the specification merely recites several broad (and overlapping) ranges of exemplary loads without indicating the significance of such ranges or whether and how those ranges relate to cutting depth. *Id.* at 15:63–67 ("In one aspect, for example, the load can be from about 0.1 Kg to about 60 Kg. In other aspects, the load can be from about 2 Kg to about 20 Kg. In further aspects, the load may be 6 Kg to 12 Kg."). This is especially problematic since the specification also suggests that the material used may impact the effect of the load placed on the CMP pad dresser. *See id.* at 16:1–5 ("[I]n one aspect an 11.5 Kg load can allow a material removal rate from the wafer of about 200 microns per hour for Cu layers. In a related example, an 11.5 Kg load can allow a material removal rate from the wafer of about 100 microns per hour for oxides.").

Identifying various factors that may impact the asperity depth does not, however, enable a skilled artisan to make and use the claimed method of conditioning a CMP pad. *Genentech*, 108 F.3d at 1366 ("[W]hen there is no disclosure of any specific starting material or of any of the conditions under which a process can be carried out, undue experimentation is required; there is a failure to meet the enablement requirement that cannot be rectified by asserting that all the

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disclosure related to the process is within the skill of the art."). Because this limitation is required to satisfy each and every Asserted Claim, all Asserted Claims of the '802 Patent are invalid for lack of enablement.

The claim limitation "the protrusions of the plurality of superabrasive particles produce cutting depths of from about [1/10] micron[s] to about 20 microns when used to abrade a CMP pad" likewise fail to teach one of ordinary skill in the art how to make and use the claimed invention. *See Amgen*, 987 F.3d at 1086 (noting that functional claim "limitations pose high hurdles in fulfilling the enablement requirement for claims with broad functional language"); *McRO*, 959 F.3d at 1100 n.2. ("In cases involving claims that state certain structural requirements and also require performance of some function (e.g., efficacy for a certain purpose), we have explained that undue experimentation can include undue experimentation in identifying, from among the many concretely identified compounds that meet the structural requirements, the compounds that satisfy the functional requirement.").

The Asserted Claims of the '802 Patent are accordingly invalid for failure to comply with the enablement requirement under Section 112.

3. AIA § 112(b): Indefiniteness

The Asserted Claims of the '802 Patent are invalid under pre-AIA § 112, ¶ 2 or AIA § 112(b) because the '802 Patent fails to inform, with reasonable certainty, those skilled in the art about the scope of the claimed invention.

Section 112 requires that a patent "particularly point[] out and distinctly claim[] the subject matter which the applicant regards as his invention." Pre-AIA § 112, ¶ 2; AIA § 112(b). A claim term is indefinite if it fails to inform those skilled in the art "with reasonable certainty . . . about the scope of the invention." *Nautilus*, 572 U.S. at 901)). "While a claim employing a 'term[ ] of degree' may be definite 'where it provide[s] enough to certainty to one of skill in the art when read

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in the context of the invention,' a term of degree that is 'purely subjective' and depends 'on the unpredictable vagaries of any one person's opinion' is indefinite." *Intell. Ventures*, 802 F.3d at 1381 (quoting *Interval Licensing*, 766 F.3d at 1371; *Datamize*, 417 F.3d at 1350–51); *see also Cypress Lake Software*, 382 F. Supp. 3d at 610 ("It is well established that the meaning of a claim limitation 'cannot depend on the undefined views of unnamed persons, even if they are experts, specialists, or academics.'" (citation omitted)); *id.* (finding claims including terms "more convenient" and "permits a user to conveniently enter" to be indefinite because "each disputed phrase is 'highly subjective and, on its face, provides little guidance to one of skill in the art'" (citation omitted)). Furthermore, a claim that covers both "an apparatus and method of use of that apparatus" is indefinite. *IPXL Holdings*, 430 F.3d at 1384.

Notably, while it can be ascertained that certain prior art is within the scope of the claims, at least the outer boundaries of the claims are uncertain in view of the above limitations, creating an unacceptable "zone of certainty" such that the claims fail to set forth the scope of the alleged invention with reasonable certainty. *Nautilus*, 572 U.S. at 909–10 (citation omitted).

The Asserted Claims are rendered indefinite and therefore invalid because at least the following limitations fail to set forth the scope of the alleged invention with reasonable certainty:

Claim Terms	'802 Patent Asserted Claims
"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"	All Asserted Claims
"the difference in protrusion distance between the highest protruding tip and the [second/10th/100th] highest protruding tip"	All Asserted Claims
"designated profile"	All Asserted Claims
"tip variation"	All Asserted Claims
"from about 5 microns to about 100 microns" / "less than or equal to about 50 microns" / "within about 90 microns or less"	All Asserted Claims
"the plurality of working superabrasive particles, such that rotating the dresser against a CMP pad cuts asperities into the	6–12

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CMP pad having a cutting depth of less than or equal to about 50 microns"	
"includes at least [about] [100/1000] working superabrasive particles"	8–9, 12
"the highest protruding tip of each of the plurality of superabrasive particles align along the designated profile with a tip variation of [from about 10/20 to about 50/40 microns] [less than about 20 microns]"	13–15
"the protrusions of the plurality of superabrasive particles produce cutting depths of [less than about 20 microns] [from about 1 micron to about 20 microns] [from about 10 microns to about 20 microns] when used to abrade a CMP pad"	16–18
"an even distribution of the plurality of superabrasive particles spaced at a distance of from about 100 microns to about 800 microns"	21

As one example, "the [second/10th/100th] highest protruding tip" limitation is not reasonably certain because the specification fails to inform those skilled in the art how to measure relative protrusion or height difference and because the point of reference is not clear. For example, the specification vaguely notes that "the term 'protrusion' refers to the height of a particle relative to some reference point," without providing the reference point to make the determination as claimed. *See, e.g.*, '802 Patent at 16:24–30 ("It should be noted that for the purposes of the present disclosure, the term 'protrusion' refers to the height of a particle relative to some reference point . . . such as, for example, the highest particle tip, a surface of a rigid support, the bottom surface of the matrix, etc."); *id.* at 10:35–38 ("[A] relative protrusion or height difference between two particles would be the difference in the heights between these particles measured from a common reference point."); *id.* at 16:20 (noting that various methods can be utilized to measure superabrasive particle tip height to determine the difference in protrusion between tips" and, thus, "any method for making such a determination is considered to be within the present scope")

Additionally, the term "highest" is not reasonably certain where, as here, the specification does not provide sufficient disclosure of how to determine which protruding tip is "the second

highest" and which protruding tips are "the [10th/100th] highest" when a monolayer of superabrasive particles comprises more than one "highest" protruding tip. For example, if a pad has three particles with heights of 60 microns, 60 microns, and 40 microns, respectively, the specification provides no guidance as to whether "the second highest protruding tip" is the second particle having a height of 60 microns or the particle having the lower height of 40 microns.

Moreover, the full scope of those claim limitations is not reasonably certain at least because the specification provides no guidance for the outer boundaries of "difference in protrusion distance." *See, e.g.*, '802 Patent at 14:38–41 ("It is noted that the term 'protrusion difference' can also be used to describe the difference in protraction distance between any two or more super abrasive particles."); *id.* at 15:1–3 ("It is noted that the recited protrusion distances can include a distribution across the entire monolayer surface or a discreate area or segment of the monolayer.").

As another example, the scope of the claim limitation "the 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" is not reasonably certain at least because the specification fails to provide sufficient guidance or parameters of the asperities "having a cutting depth of less than or equal to about 50 microns."

The claim limitation "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" is likewise unreasonably certain because the specification fails to provide sufficient guidance or parameters regarding the "tip variation of from about 5 microns to about 100 microns." That is, the specification does not make clear how to decipher whether a designated profile satisfies the claimed tip variation range. Indeed, the specification acknowledges that "[w]hile it is intended that the tips of the superabrasive particles align along a designated profile, some level of deviation

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may occur" as "a result of the design or manufacturing process of the tool." '802 Patent at 11:35–39; *see also id.* at 17:13–15. The specification further points out that "[g]iven the wide variety of sizes of superabrasive particles that may be potentially utilized in a given tool, such deviations may be highly dependent on a particular application." *Id.* at 11:39–42.

Further, the full scope of claim limitations like "from about 5 microns to about 100 microns" and "less than or equal to about 50 microns" and "within about 90 microns or less" is not reasonably certain because the specification provides no guidance for the outer boundaries of such numerical ranges, where "the term 'about' is used to provide flexibility to a numerical endpoint by providing that a given value may be 'a little above' or 'a little below' the endpoint." *Id.* at 8:29–32; *see also id.* at 9:3–11, 18–21 ("It is to be understood that . . . a range format [reciting only one numerical value as a minimum or a maximum] is used merely for convenience and brevity and thus should be interpreted flexibly to include not only the numerical values explicitly recited as the limits of the range, but also to include all the individual numerical values or sub-ranges encompassed within that range as if each numerical value and sub-range is explicitly recited. . . . Furthermore, such an interpretation should apply regardless of the breadth of the range or the characteristics being described.").

The above limitations accordingly fail to set forth the scope of the claimed invention with reasonable certainty. Because several such limitations are required to satisfy every Asserted Claim of the '802 Patent, all Asserted Claims are indefinite and therefore invalid under § 112.

D. Additional Reasons for Invalidity of the'802 Patent

Claims 1–5, 13, 15, 19–21 of the '802 Patent are anticipated and/or rendered obvious, and claims 1–21 of the '802 Patent are rendered obvious, by prior art for at least the reasons provided in IPR2024-00535 filed on February 29, 2024, which is herein incorporated by reference in its entirety. *See* SAMSUNG_CMS_001778–SAMSUNG_CMS_002732.

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Dated: April 10, 2024 By: */s/ Taeg Sang Cho*

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing document has been served upon counsel of record via electronic mail on April 10, 2024.

/s/ David Cho
David Cho

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