

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

MICRON TECHNOLOGY, INC.,
Petitioner,
v.
YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,
Patent Owner.

Case No. IPR2025-00189
U.S. Patent No. 11,145,666

PETITIONER'S REPLY

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LISTING OF EXHIBITS

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1001	U.S. Patent No. 11,145,666 B2 to Lu et al. (the “’666 patent”)
1002	File History of U.S. Patent No. 11,145,666 B2 to Lu et al.
1003	Declaration of Dr. Jack C. Lee
1004	<i>Curriculum Vitae</i> of Dr. Jack C. Lee.
1005	U.S. Patent No. 10,229,929 to Kim et al. (“Kim”)
1006	U.S. Patent Publication No. 2018/0026046 A1 to Nam et al. (“Nam”)
1007	U.S. Patent Publication No. 2014/0191389 A1 to Lee et al. (“Lee”)
1008	U.S. Patent No. 10,297,543 to Park et al. (“Park”)
1009	U.S. Patent No. 9,589,978 to Yip
1010	Aritome, “NAND Flash Memory Technologies” (2016)
1011	Micheloni et al., “Inside Solid State Drives (SSDs)” (2nd Ed. 2018)
1012	Silvagni, “3D NAND Flash Based on Planar Cells,” Computers 2017
1013	Excerpts from the File History of PCT/CN2018/098962.
1014	File History of U.S. Patent No. 10,680,003 (Appl. 16/126,956)
1015	U.S. Patent Publication No. 2015/255385 to Lee
1016	U.S. Patent No. 9,373,540 to Hyun
1017	U.S. Pub. 2011/0031630 A1 to Hashimoto
1018	U.S. Patent No. 9,343,452 to Yun et al.

Exhibit	Description
1019	Minute Order (case schedule), Dkt. No. 141, dated September 18, 2024 in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1020	Combined Civil and Criminal Federal Court Management Statistics (December 31, 2023), available at https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distcomparison1231.2023.pdf
1021	Plaintiff and Counterclaim Defendant Yangtze Memory Technologies Company, LTD.'s Disclosure of YMTC II Asserted Claims and Infringement Contentions, dated October 2, 2024 in <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:23-cv-05792-RFL
1022	Docket from <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and Micron Consumer Products Group, LLC</i> , Case No. 3:24-cv-04223-RFL which has been consolidated with Case No. 3:23-cv-05792-RFL
1023	Declaration of Jared Bobrow in Support of Petitioner's Motion for Admission <i>Pro Hac Vice</i>
1024	Excerpt from the <u>Merriam Webster Dictionary</u> (1998)
1025	Falcony, <u>Characterization of Excess Si in Nonstoichiometric SiO₂ Films by Optical and Surface Analysis Techniques</u> , J. Electrochem. Soc., Vol 144, No. 1, 379-383 (Jan 1997)
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I. INTRODUCTION

Petitioner Micron submits this reply to Patent Owner's Response (Paper 25) to the Petition for *Inter Partes* Review of the '666 patent.

The only claim limitation Patent Owner identifies as purportedly missing from the prior art is a memory landing pad with a "curved side surface" in "contact" with the "side surface" of an "insulating layer." While certain of the '666 patent's figures appear to depict a pad with this type of curved surface, the specification does not even use the word "curved." It never explains why shaping a landing pad in this way is important. It does not explain how such a pad is formed. In contrast, the Petition's prior art not only explicitly discusses memories using "curved" landing pads, but it both articulates the benefits of such pads and provides numerous examples of pad manufacturing methods. Given this disparity in disclosure—the '666 patent discloses virtually nothing, while the prior art is comprehensive—there is no question that the claims are obvious.

Rather than accepting the '666 patent for what it is, most of Patent Owner's Response attempts to transform the patent and the claims into something they are not. The claims reference a "curved side surface." They do not say—as Patent Owner now argues—that this "surface" needs to be "vertical" and curved only in the "z-axis" direction. Similarly, the claims allow for the "side surface" of the "insulating layer" to be any of the layer's surfaces. It does not need to be the side

surface at the very end of the insulating layer (as opposed to an intermediate side). The specification also makes clear that the patent is not limited in any of these ways: it notes that its figures are non-limiting embodiments, explains that a “layer” can have a complicated three-dimensional shape with many sides, uses words like “vertical” and “horizontal” that are not found in the claims, and even characterizes a layer’s “top” and “bottom” as “sides.”

Moreover, Patent Owner’s technical arguments lack record support. There is no reason why a POSITA would have been unable to employ a curved landing pad with the Petition’s prior art given that this type of pad was well known, was achievable via a variety of different proven and well-known manufacturing methods, and provided recognized benefits (such as the elimination of short circuits).

The Board already assessed and rejected most of Patent Owner’s arguments when instituting. Patent Owner’s Response presents nothing that justifies reaching a different conclusion now.

II. ARGUMENT

A. Claim Construction

According to Patent Owner, claim 19 (via its dependency on claim 17) somehow requires (1) that the pad’s “curved side surface” be “vertical” and “curved along ... the z-axis” and (2) that the “side surface of the insulating layer” be an external and not “an internal or inner surface.” Response, 1, 8, 39. Neither the

claims nor the specification require, much less suggest, any of this. Patent Owner reads in limitations and invites error. Moreover, in addition to being wrong, Patent Owner's claim construction arguments are largely irrelevant. All of the prior art discussed in the petition includes "vertical[ly]" oriented curved surfaces. The art is also replete with example landing pads that are "curved" in the z-axis direction.

1. *Patent Owner's Construction Is Contrary to the Claims*

Claim construction begins with the claim language. And "[t]he words of a claim are generally given their ordinary and customary meaning..." *Thorner v. Sony Comput. Entm't Am., LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Patent Owner fails to point to any claim language requiring the many narrowing limitations it now seeks to impose. Claim 19 (and claim 17 on which it depends) does not use the words "vertical" or "z-axis." The claim also does not mention (or exclude) "internal" or "inner" insulating layer surfaces. Instead, all that the claim requires is a landing pad with "a curved side surface" that contacts a "side surface" of the "insulating layer." '666 patent, claim 17. This alone requires rejection of Patent Owner's arguments. *Johnson Worldwide Assocs., Inc. v. Zebco Corp.*, 175 F.3d 985, 989 (Fed. Cir. 1999) ("modifiers will not be added to broad terms standing alone").

Next, a "side" of a three-dimensional object is any "outer surface of [the] object." Ex. 1024, 483. This is exactly how claim 19 uses the term "side": to refer

to any of the various surfaces making up the claimed “second portion of the conductive layer” (or landing pad) and “insulating layer.” This “side” can be the top, bottom, left, right, front, or back of a “layer.” It can be a vertical or horizontal surface, or a surface that includes both vertical and horizontal components. The “side” can be at the end of a layer, or it can be an internal “side” that bounds a hole through the layer. Nothing about the claim language precludes any of this. Indeed, Petitioner’s expert Dr. Lee repeatedly explained this to Patent Owner during his deposition, noting that the layers discussed in the ’666 patent are “three-dimensional structure[s]” with “many sides” (*i.e.*, “at least six sides”). Ex. 1015, 71:3-72:14; *see also* 79:18-80:16, 101:17-102:10; Ex. 1027, ¶¶ 8-19.

According to Patent Owner, claim 17 “contrasts vertical ‘side surface[s]’ with horizontal ‘top surface[s]’/‘bottom surface[s].’” Response, 9. It does no such thing. Once again, the claim does not use the term “vertical” or “horizontal.” While claim 17 does reference “a top surface,” it does so only in connection with the “substrate.” ’666 patent, claim 17. This does not operate to limit what constitutes a “side surface” of the separately recited “second portion of the conductive layer” or “insulating layer.” Nor does the reference to a “landing pad” with “top surface,” “bottom surface,” “first side surface” and “second side surface” in claims 1 and 2 mean that the “side surface” in claim 19 must be “vertical.” Response, 9-10. At best this shows that the applicant *knew* how to craft a claim that distinguishes the “top surface” and

“bottom surface” of a “layer” from other “side surface[s].” The applicant chose not to do so in claim 19. *Karlin Tech., Inc. v. Surgical Dynamics, Inc.*, 177 F.3d 968, 971-72 (Fed. Cir. 1999) (“different words or phrases used in separate claims are presumed to indicate that the claims have different meanings and scope”). So, the term “side surface” in the claim embraces any of the landing pad’s sides, including the top, bottom, lateral sides, and so on.

Next, even if claim 19 did somehow require that the “curved side surface” be “vertical” (it does not), it most certainly does not require a curve “along ... the z-axis.” The “side surface” can be curved in any direction. So long as there is surface curvature, the claim is satisfied. Patent Owner points to nothing in the claim that even remotely suggests otherwise.

2. *The Specification Uses “Side Surface” in a Manner Consistent with Its Ordinary Meaning*

Patent Owner’s narrowing constructions also find no support in the specification. Indeed, the specification **confirms** that the “curved side surface” cannot properly be limited in the way that Patent Owner proposes.

To begin, the word “curved” does not appear anywhere in the ’666 patent’s specification. The specification does not attribute any importance to this claimed feature, or state that the claimed “curved side surface” must curve in any specific way. Further, the specification includes a lengthy section that defines, among other terms, “horizontal” and “vertical.” ’666 patent, 5:3-13. Terms like these plainly

could have been included in claim 19 to further characterize the claimed “curved side surface” or “side surface of the insulating layer.” But neither was, implying that the applicant intended the claims to more broadly embrace horizontal, vertical, and other differently oriented surfaces. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 807 (Fed. Cir. 2007) (claims not limited where “the specification ... suggests that the patentees knew how to” use narrowing language but instead “chose a different term that implies a broader scope”); Ex. 1028, 51:24-52:7 (no explicit definition of “side” or “side surface”).

Despite this, Patent Owner argues that the '666 patent somehow “define[s]” the term “side” as a vertical surface by “implication.” Response, 19. According to Patent Owner, “each of the 53 references to a ‘side’ or ‘side surface’ in the '666 patent are all shown or understood to be vertical surfaces in a vertical direction.” *Id.* This is not how claims are construed. *Acumed*, 483 F.3d at 807 (declining to import a limitation from specification even though “every description” of the patent’s embodiments “contemplates” presence of that limitation). Moreover, in virtually all cases, the '666 patent characterizes vertical surfaces as “a side.” *E.g.*, '666 patent, 2:17, 2:21, 2:29, 2:53, 8:25-26, 8:39. The patent’s repeated use of the article “a” makes clear that this referenced “side” is simply one of many sides. In any event, the patent unambiguously explains that “phraseology and terminology” it uses “is

for the purpose of description and **not of limitation**....” *Id.*, 13:19-24 (emphasis added).

Far from excluding non-vertical surfaces from the scope of the term “side,” the ’666 patent specification states that such surfaces are meant to be **included**. In particular, the specification explicitly characterizes both the “top” and the “bottom” of a “layer” (which are horizontal, not vertical) as “side[s].” ’666 patent, 4:36-40. Plainly, the ’666 patent uses the term “side” in a way consistent with its plain and ordinary meaning: to refer to any of the various bounding surfaces of a three-dimensional shape. *See also* Ex. 1027, ¶¶ 20-22.

Patent Owner similarly argues that “curved side surface” must be narrowly interpreted because the patent’s “only embodiment” (shown in Figure 8) includes a vertically oriented surface that is purportedly curved in the z-axis direction. Response, 17-18. Patent Owner also posits that this “is the only kind of curved side surface that can be formed from the only process disclosed in the ’666 patent.” *Id.*, 19. But “features recited in the specification merely as aspects of embodiments, and not expressly or even implicitly identifying requirements of the invention, do not narrow a claim term that is otherwise broader in its ordinary meaning.” *Promptu Sys. Corp. v. Comcast Corp.*, 92 F. 4th 1372, 1379 (Fed. Cir. 2024). Moreover, “[e]ven when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear

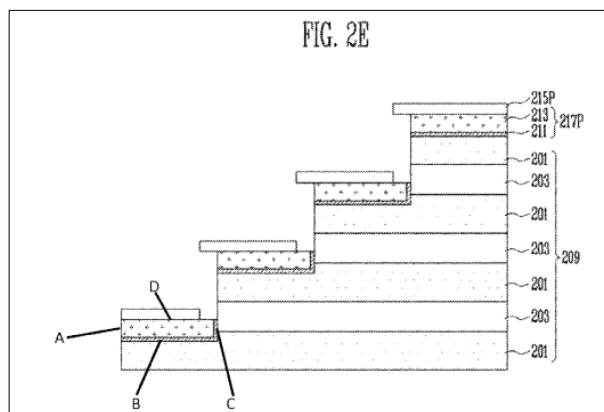
intention to limit the claim scope using ‘words or expressions of manifest exclusion or restriction.’” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004). Rather than limiting itself to just what is shown in Figure 8, the ‘666 patent explains that this is simply an “embodiment[.]” ’666 patent, 1:37-41, 13:10-40. Further, the patent notes that there is only “contact” between an insulating layer and landing pad in “some” (but not necessarily all) “embodiments” of the purported invention. *E.g.*, 2:46-57. The specification also concludes by explaining that its embodiments are simply examples that are meant to be “readily modified.” *Id.*, 13:10-40. So, the particular type of curved side shown in the figures is an optional—not a required—feature. The specification also says nothing about how “curved” pad sides are to be formed. It does not mention use of a method with “directional and isotropic flux components” like that discussed in Patent Owner’s response (*see* Response, 19). Instead, the patent is expressly open to the use of “any suitable deposition techniques” when forming its layers. ’666 patent, 2:39-45, 8:65-9:7; Ex. 1028, 34:3-35:8 (CVD can produce good step coverage); Ex. 1027, ¶¶ 23-30.

Likewise, there is nothing in the specification that requires that the claimed “side surface” of the “insulating layer” be an external (as opposed to an inner or internal) side surface. While this appears to be what some of the ’666 patent’s figures show, the claims cannot be properly limited to just that. *Promptu Sys.*, 92 F.4th at 1379. Moreover, the patent explains that a “layer” can “extend horizontally,

vertically, and/or along a tapered surface,” have different thicknesses, and can even be formed from “multiple layers” with different physical extents. ’666 Patent, 4:48-57. This is plainly referring to a potentially complicated three-dimensional structure with many distinct sides, including a top side, bottom side, vertical sides, internal sides, and the like.

3. *The ’666 Patent’s Prosecution History Is Inconsistent with Patent Owner’s Construction*

If all this were not enough, the prosecution history of the ’666 patent undermines Patent Owner’s construction. “Side” must be construed in accordance with its ordinary meaning. During prosecution of one of the patent’s parent applications, Patent Owner was pursuing claims directed to a “semiconductor structure” with a “landing pad” having a “first side surface and a second side surface.” Ex. 1014, pp. 241-242. The examiner rejected the claims in view of the following prior art memory structure:



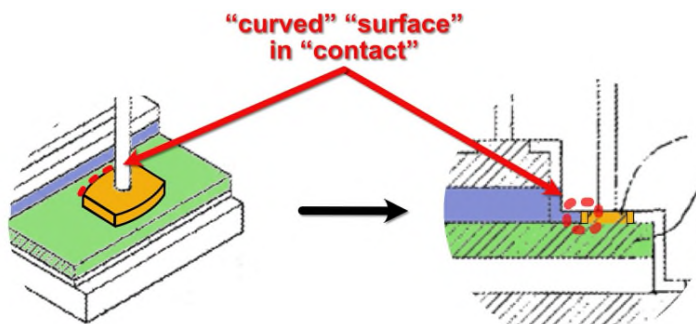
Id., p. 270. The examiner explained that this memory includes a “landing pad” with

“4 side surfaces: A, B, C, and D.” *Id.*, p. 269. “Sides B and D” (the top and bottom) corresponded to the claimed “side surface[s].” *Id.* Patent Owner did not dispute the Examiner’s characterization of the landing pad’s top and bottom as “side surfaces.” *Id.*, pp. 282-290. Instead, it amended the claims to require that the claimed “side surface[s]” be only those surfaces that are “substantially perpendicular to the top surface” of the substrate. *Id.*, pp. 284-285 (emphasis added). No such limitation is present in the ’666 patent claims. As a result, its claims embrace all possible “side surfaces” of a “layer,” including the top and bottom. *See also* Ex. 1027, ¶¶ 31-36.

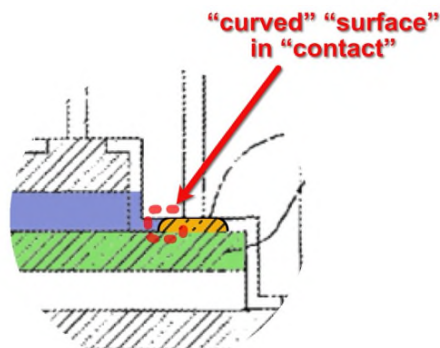
B. Ground 1: Obviousness Over Kim

Ground 1 in the Petition explained why claim 19 would have been obvious over Kim. Petition, 33-56. Kim employs different types of landing pads with “curved side surface[s]” in “contact” with an adjacent insulating layer. *Id.*, 45-52. Kim’s pads can “have a shape including a curved surface based on a virtual rectangular parallele shape, a cylindrical shape, or any shape.” Kim, 8:29-34. As explained in the Petition, this includes both (1) generally cylindrical pads that are curved when viewed from above and (2) pads that are curved when viewed in cross section:

Generally cylindrical pad:



Pad curved in cross section:



Petition, 46, 52. **Both** types of pad satisfy claim 19.

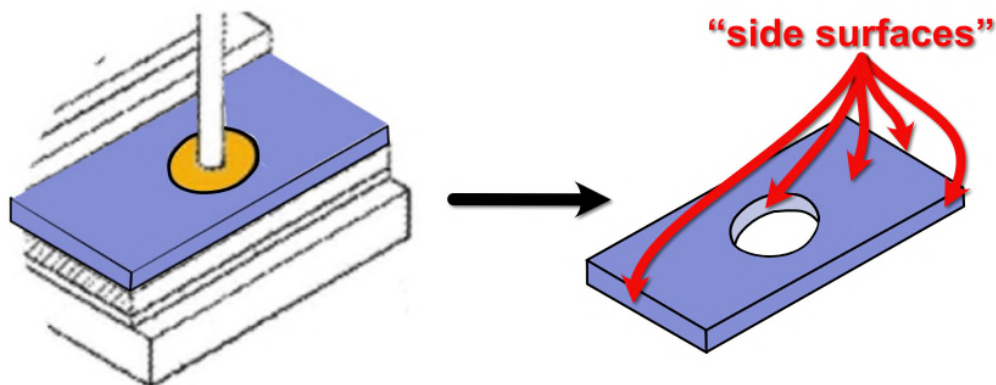
1. Kim's Generally Cylindrical Landing Pads Satisfy Claim 19

Patent Owner does not dispute that Kim teaches pads with a “cylindrical” shape. Response, 35. Nor does it dispute that Kim’s existing manufacturing process can be used to produce such a pad. *Id.*; Ex. 1028, 62:5-63:16, 65:6-12 (cylindrical pads “consistent” with Kim). Instead, Patent Owner argues only that cylindrical pads are unclaimed because they do not “curve vertically” along the “z-axis.” *Id.*, 36.

Claim 19 is not limited in this way. The claim is open to **any** type of “curved side surface.” It does not require a curve in any particular direction, let alone “vertical” along the “z-axis.” *Supra* Section II.A. It follows that Kim’s cylindrical pad satisfies claim 19: it has a “curved side surface” (the surface following the shape

of a cylinder when viewed from above). Holding otherwise would improperly import structural features from the '666 patent's figures into the claims. *E.g.*, *Promptu Sys.*, 92 F.4th at 1379 (claims not limited to embodiments).

Patent Owner next argues the “curved” surface of Kim’s cylindrical pad purportedly does not “contact” a “side surface” of the “insulating layer.” Response, 37. Patent Owner posits that because insulation extends around the pad, the curved side of the pad only contacts what Patent Owner characterizes an “internal or inner surface, not a side surface” of the insulating layer. *Id.*, 38-39. This also improperly reads in a limitation. Claim 19’s “side surface” does not need to be at the layer’s very end. Any of the layer’s sides can be the claimed “side surface.” *Supra* Section II.A. All the sides of Kim’s insulating layer—including the layer’s top, bottom, front, vertical surfaces, and the side bounding the hole in which the pad is located—are “side surfaces”:



Response, 38 (annotating Fig. 6 of Kim, with further figure labeling of “side surfaces” added to the right by Petitioner). One of these—the “side surface”

bounding the hole containing Kim's pad—satisfies claim 19: it is a “side surface” that is in “contact” with the “curved side surface” of the pad. Petition, 51-53; Ex. 1028, 66:9-17 (confirming landing pad contact).

2. *Kim Also Renders Obvious Pads Curved When Viewed in Cross Section*

Patent Owner's arguments regarding the second type of “curved” landing pad referenced in Kim also lack merit. To begin, Patent Owner wrongly characterizes the Petition as trying to substitute various prior art pad designs into Kim. *E.g.*, Response, 29, 42. This, however, is something a POSITA would have understood that Kim already teaches. Kim references not only “cylindrical” pads but also pads that “includ[e] a curved surface based on a virtual rectangular parallele shape.” Kim, 8:29-35. A POSITA would have considered this to be an obvious reference to the types of vertically curved pads routinely disclosed in and used by the prior art. Petition, 45-49 (Exs. 1006, 1008, and 1018 examples of “curved” pads). Patent Owner does not dispute that the prior art includes numerous examples of landing pads with curved sides when viewed in cross section. It also does not dispute that this type of pad satisfies claim 19. Instead, it argues only that “Kim's manufacturing process cannot produce” a “vertical” “curved” “surface.” Response, 30. It also argues that a POSITA would not be motivated to use such a pad even if it could be produced. *Id.*, 2, 39.

Patent Owner improperly assumes that Kim is limited to just one pad manufacturing method. It is not. Instead, Kim repeatedly makes clear that the process it discusses is merely an example. Kim, 12:12-15 (“some embodiments” employ the discussed method); 12:38-42 (explaining that while “one process[]” for forming layers is discussed, Kim “is not limited thereto”); 12:61-13:4 (“[a]n ion injection process may be performed”) (all emphasis added). In other words, Kim is open to the use of any method capable of producing the types of contact pads it discusses. Park (Ex. 1008), Nam (Ex. 1006), and Yun (Ex. 1018) not only provide examples of contact pads with “curved side surfaces,” but explain how such pads can be manufactured. Petition, 50-51. Any of these methods—when applied to Kim—produce a pad with a “curved side surface.” Ex. 1003, ¶¶ 203-222, 226-238.

Next, even if a POSITA did attempt to maintain as much of Kim’s existing manufacturing process as possible, a rounded contact pad would still have been readily achievable. To form its contact pads, Kim forms a “photosensitive resin pattern M ... on the auxiliary insulating layer...” Kim, 12:61-64. Openings are formed in this pattern M “expos[ing] the region 122_I...” *Id.*, 12:65-67. Then, “[a]n ion injection process” results in the “regions 122_I” being “doped” with impurity having “a different etching ratio” from the surrounding insulating material. *Id.*, 13:5-11. The size of the opening (and thus the size of the doped region 122_I) can be controlled. *Id.*, 11:57-59 (noting that “the sizes of the ... protrusion pads ...

may be different”). The doped regions are then etched resulting in openings 122_O that are later replaced with conductive material to form the pads. *Id.*, 13:51-67.

This process is readily tailorable to form the types of curved pads oft taught in the prior art. Ex. 1003, ¶ 234. Indeed, the prior art discussed in the Petition provides two example methods for doing so. Park (Ex. 1008) explains that rounded contact pads can be formed by performing both “ion implantation” and “oxidation” processes. Park, 8:33-49. This same process would result in rounded contact pads in Kim: after performing ion implantation and etching to form the openings 122_O, an oxidant would be flowed into the openings to further oxidize the exposed side surfaces, resulting in rounding (and eventually a matching curved contact pad). Ex. 1027, ¶¶ 41-49. Nam (Ex. 1006) provides another example. To form its curved pads, Nam performs multiple ion-injection steps targeting different areas in the insulating material. Nam, ¶¶ [0099]-[0100]. Then, “heat” is “applied thereto in a subsequent process,” causing ion-injected impurities to “spread” and resulting in the desired curved shape. *Id.*, ¶¶ [0060], [0090]. This same process also would result in curved contact pads in Kim: ion implantation would occur the same way it currently does. Then, a heating step would cause the impurities to spread or diffuse, resulting in a rounded opening 122_O after etching and a resultant curved pad. Ex. 1027, ¶¶ 50-52; *see also* Ex. 1003, ¶¶ 236-238 (explaining how Park’s ion

implantation and oxidation steps and Nam’s ion implantation procedure form curved contact pads).

These prior art methods for forming curved pads are not “fundamentally different” from that employed by Kim. Response, 45. Again, Kim *does not require* use of the exact, exemplary manufacturing method it discusses in its specification. Further, Kim already employs ion implantation and etching steps that are analogous to those discussed in both Park and Nam. *Compare* Kim, 12:61-13:11 *with* Park, 8:33-49 and Nam, ¶¶ [0099]-[0100]. Use of Park’s method requires nothing more than an additional oxidation step after etching. Ex. 1027, ¶¶ 53-56. And use of Nam’s methods requires only an additional heating step after impurity implantation. *Id.*, ¶¶ 55, 57-59. These are not “fundamental” process differences: they are the application of known, routinely used process steps as part of ordinary design work. *Id.*, ¶ 55.

Patent Owner’s motivation to combine arguments also lack merit. Per Patent Owner, Kim “already offers three solutions to prevent short-circuits[.]” Response, 2; *see also* 39. This, according to Patent Owner, makes curved contact pad sides unnecessary. *Id.* It does not. Kim’s repeated reference to short circuits (*e.g.*, Kim, 9:7-11, 9:46-49, 9:50-55), would have made it clear to a POSITA that Kim not only recognizes short circuiting as a problem, but is open to design modifications addressing this problem. Ex. 1027, ¶¶ 60-64. So, far from leading a POSITA away

from the use of a curved landing pad, the discussion of short circuits in Kim motivates use of a such a pad. *Id.*, ¶ 64; Ex. 1028, 57:12-25 (short-circuit avoidance is “basic” and “absolute requirement”), 59:20-61:10 (“very, very well known” to “optimize ... structure” to avoid short-circuits).

The methods Kim already employs to minimize short circuits further emphasizes this. To address short circuits, Kim adjusts the size, shape, and positioning of its pads. Kim, 9:46-49 (noting that Kim’s pad can be sized and located “inside from the edge surface” of the base pad “to prevent ... short-circuit”). It also adds thickened layers of insulation around the pad. *Id.*, 9:50-55 (“auxiliary insulating layer 122” is “positioned between ... adjacent protrusion pads”), 9:7-11 (insulation “thickness” is increased to “prevent[] ... short circuit”). A curved shape increases the distance between the landing pad and adjacent conductive structure. Ex. 1027, ¶ 62. A curved shape also increases the thickness of insulation surrounding the landing pad. *Id.*, ¶ 63. Thus, use of a curved contact/landing pad is nothing more than a straightforward extension of the short-circuit preventing approaches Kim already employs. *In re Williams*, 36 F.2d 436, 438 (C.C.P.A. 1929) (changes of “form, proportions, or degree” obvious); *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018) (routine optimization obvious). Further, the repeated disclosure of rounded landing pads in the prior art makes clear that a POSITA would have considered this design suitable for use. *Bayer Pharma AG v.*

Watson Labs., Inc., 874 F.3d 1316, 1328 (Fed. Cir. 2017) (“[O]bviousness does not require that the motivation be the *best* option, only that it be a *suitable* option....”).

The cases that Patent Owner cites (*see* Response, 41-42) say nothing to the contrary. In one case, there was no indication of “what features of the references, or even which references, would be combined....” *In re Anova Hearing Labs, Inc.*, 809 F. App’x 840, 843 (Fed. Cir. 2020). Because of this, the Federal Circuit determined that the Board had failed to properly articulate a motivation to combine. *Id.* Here, the Petition explains exactly what feature is employed with Kim (a rounded contact pad). It also explains why a POSITA would have employed such a feature (it was both well-known and furthers Kim’s goal of reducing the risk of short circuits). In another case, a patent challenger argued that an unneeded, redundant component from a secondary reference would be grafted onto a primary reference. While it later changed position to argue that the component could be substituted instead to improve the primary reference, the Federal Circuit determined that the “substitution theory” was “waived.” *South-Tek Sys., LLC v. Engineered Corrosion Sols., LLC*, 748 F. App’x 1003, 1006-07 (Fed. Cir. 2018). Here, the Petition did not argue that an unneeded, redundant set of contact pads should be added to Kim. It explained why a POSITA would have been motivated to make Kim’s existing pads curved (as Kim already teaches). In any event, this entire portion of Patent Owner’s response is irrelevant. A proposed combination need only constitute a “suitable” option, not a

categorical “improvement” over the prior art. *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380-81 (Fed. Cir. 2023). Patent Owner does not dispute that curved pads are one known—and suitable—way to address short circuits.

C. Ground 2: Obviousness Over Nam

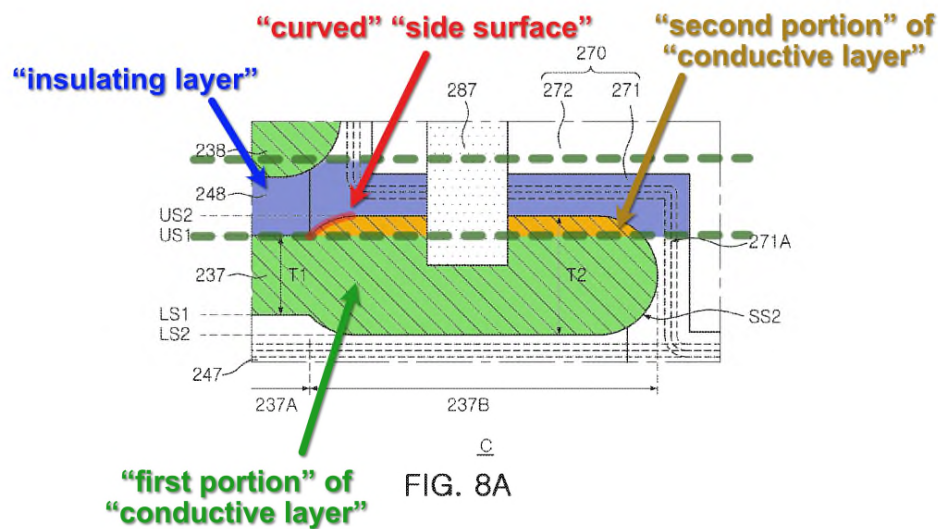
Ground 2 in the Petition demonstrated why claim 19 is obvious in view of Nam. Petition, 56-70. Patent Owner begins its Response by arguing—with reference to the Petition’s annotated figures—that the Petition “arbitrarily identifies the claimed ‘insulating layer’” in multiple supposedly “inconsistent” and “different ways.” Response, 50. According to Patent Owner, this is somehow “fatal to Petitioner’s claims.” *Id.*, 57.

There is no inconsistency. The Petition’s annotated figures each highlight different aspects of Nam’s “insulating layer” relevant to different claim limitations. One figure shows why Nam includes an “insulating layer” that is “disposed over a first portion of a conductive layer” and part of a “layer stack.” Petition, 59-61. So, the Petition highlights the alternating layers of insulation and conductive materials that form Nam’s stack. *Id.*, 61. Another figure shows why Nam’s “insulating layer” includes a “side surface” in “contact” with the “curved side surface” of a landing pad. *Id.*, 62-67. So, the Petition highlights the portion of the insulating layer that contacts Nam’s pad. *Id.*, 67. Yet another figure shows why Nam includes an “adjacent” “insulating layer” in its stack. *Id.*, 70. So here, the adjacent layer is

highlighted. *Id.* And another figure addresses the limitation requiring an adjacent layer of insulation including a “second portion” that is “laterally displaced” from the “conductive layer.” *Id.*, 70-71. Here, the portion of insulation corresponding to this “laterally displaced” “second portion” is highlighted. *Id.*, 70. There is nothing inconsistent about highlighting different portions of the same insulating structure to explain why that structure satisfies different claim limitations. That is all the Petition does. Indeed, the Board recognized this in its Institution Decision, noting both (1) that the Petition identifies layer 240 and the adjacent portion of 271 as forming the “insulating layer” and (2) that this insulating layer does not—as Patent Owner argues—“extend only so far as the blue shading” in each figure. Institution Decision (Paper 19), 24.

In addition to misrepresenting the Petition’s figure annotations, Patent Owner entirely ignores that the Petition also discussed what constitutes the claimed “insulating layer” in words. The Petition repeatedly explained that Nam’s “insulating layer” includes “insulating layer 240 and the adjacent insulating layer 271.” *E.g.*, Petition, 60, 61, 67, 68. The Petition also explained why these layers together form the claimed “insulating layer”: they (1) are “located between” adjacent “gate electrode layers 230,” (2) cooperate on a layer-by-layer basis to “define the shape of Nam’s pads,” and (3) are “formed from the same” insulating “material.” *Id.*, 60. The ’666 patent defines “layer” to include this very type of structure: a

“layer” can include “multiple layers” and be the material located “between any set of horizontal planes.” ’666 patent, 4:36-45. This is no different than Nam’s layer 240 (also called 247, 248, etc.) and adjacent layer 271. Layer 248 and the adjacent portion of layer 271 (both blue) form a continuous structure and are located between the planes (dark green dashed lines) formed by the bottom surface conductive layer 238 (lighter green) and top surface of conductive layer 237 (also lighter green):



Ex. 1027, ¶¶ 65-77.

Next, Patent Owner wrongly speculates that the entirety of layer 271—across all of Nam’s layer—must be the “insulating layer.” Response, 53. This is not what the Petition argued. It is layer 240 and the “adjacent” portion of “insulating layer 271” that make up the claimed “insulating layer.” *E.g.*, Petition, 60 (emphasis added). Once again, this is consistent with the ’666 patent specification, which explains that the claimed “insulating layer” is the material “between any set of

horizontal planes” (only the adjacent portion of layer 271 on a particular staircase level—not all of it across all levels—is between the set of planes formed by two adjacent conductive layers).

Patent Owner concludes its discussion of Nam by arguing that it is the “bottom surface” of Nam’s insulating layer—and not its “side”—that is in “contact” with the curved side surface of the landing pad. Response, 57. Per Patent Owner, the only “side surface” of “what Petitioner’s expert identified” as the claimed “insulating layer” is at the extreme end of layer 271. *Id.*, 59. Again, claim 19 references only “a side surface of the insulating layer.” This “side surface” does not need to be a vertical surface. *Supra* Section II.A. Moreover, even if this were required, the insulating layer “side surface” identified in the Petition is vertical. Petition, 67. There is also no requirement that the “side surface” be at the extreme end of the insulating layer. Any “side surface” qualifies, including those located at the end, in the middle, or at other points along the length of a particular layer. The bounding surface of Nam’s “insulating layer” identified in the petition is one such “side surface.” Ex. 1028, 87:9-88:2 (confirming pad contact).

D. Ground 3: Obviousness Over Lee and Park

Ground 3 of the Petition explained why the claims are obvious over the Lee and Park. Petition, 72-90. Here, Patent Owner argues that “Petitioner does not establish why a POSITA would have been motivated to” employ a rounded pad with

Lee, “or have a reasonable expectation of success” when doing so. *Id.*, 62. It is wrong on both counts.

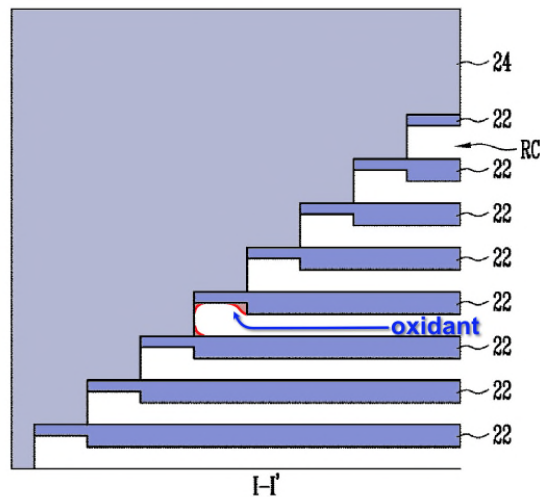
The Petition did explain why a POSITA would have been motivated to use the claimed type of landing pad. Not only were pads with curved side surfaces well known, but use of this type of pad would have reduced the risk of short circuit in Lee. Petition, 85-86. Patent Owner once again argues that “Lee already provides a method” to avoid short circuits and thus purportedly does not require “Park’s teaching.” Response, 67. This does not show non-obviousness. Lee addresses the short circuit problem by “ensuring ‘a sufficient distance ... between the stacked conductive layers (pad portions)....” *Id.* (quoting Lee, ¶ [0049].) Use of a rounded pad with “curved” sides like that in Park furthers this goal: curved pad sides increase the distance between Lee’s pad and adjacent layers of conductive material. Ex. 1003, ¶¶ 418-420.

Next, it is not “techn[ologically] infeasible” to “form Lee’s contact pads such that they have a curved side surface.” Response, 64. The Petition explained that curved pads would be achieved by following Park’s teachings and further oxidizing Lee’s insulating layers after its sacrificial layers are removed. Petition, 86-87. According to Patent Owner, it is not possible to “further oxidize” Lee’s “oxide layers” because those layers are formed from “solid” “silicon dioxide.” Response, 64.

Lee, however, explains that its insulation layers are formed from “oxide” (Lee, ¶ [0030]), not necessarily completely pure “silicon dioxide” as Patent Owner appears to assume. When the ’666 patent was filed, silicon oxide films with non-stoichiometric amounts of oxygen (*i.e.*, SiO_x , where $0 < x < 2$) were both known and in routine use. *E.g.*, Ex. 2008, 563-64 (“Silicon dioxide films ... can be nonstoichiometric”); Ex. 1025, 379 (referencing both “stoichiometric SiO_2 ” and “an oxide with about 14 a/o of Si in excess”); Ex. 1026, 508 (discussing “substoichiometric SiO_x ($0 < x < 2$) thin films”); Ex. 1029, 1:9-10, 6:45-51, 7:25-29, 8:5-16 (noting that “non-stoichiometric silicon oxides having more or less than two oxygen atoms for each silicon atoms” can be used as an “insulating layer” in a 3D memory). Because it contains excess silicon, this type of non-stoichiometric oxide layer is further oxidized when it is exposed to an oxidant. Ex. 1027, ¶¶ 79-88, 90-98; Ex. 2010, 261:20-266:1.

As Dr. Lee explained both in his original declaration and during deposition, when a silicon oxide layer is further oxidized, additional silicon oxide forms preferentially in the areas of exposed corners (red below). Ex. 1003, ¶¶ 412-413; Ex. 2010, 267:7-268:22. This includes the corners within the spaces between Lee’s existing oxide layers 22 (blue below):

FIG. 5B



Ex. 1027, ¶ 89; Ex. 1003, ¶ 413. Park employs an analogous process (just from the top of a memory staircase rather than within it). It first forms an “additional insulating layer 40” by thermally oxidizing “surfaces of the stepped sacrificial layer patterns 14a through 14f.” Park, 8:28-30. Then, it performs a further “oxidation process” on this already formed oxide to produce “rounded” sides. *Id.*, 8:37-38. So, far from being technologically “infeasible,” a POSITA would have both known how and have been motivated to apply Park’s teachings to Lee.

III. CONCLUSION

For the reasons explained above—and in the Petition—the ’666 patent’s claims are all unpatentable as obvious.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing reply complies with the type-volume limitation in 37 C.F.R. § 42.24. According to the utilized word-processing system's word count, the reply contains 5,597 words.

Dated: November 26, 2025

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CERTIFICATE OF SERVICE

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