Trials@uspto.gov
571-272-7822

Paper 13
Date: November 7, 2024

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.

IPR2024-00788
Patent 10,658,378 B2

Before JO-ANNE M. KOKOSKI, KIMBERLY McGRAW, and MICHAEL T. CYGAN, *Administrative Patent Judges*.

CYGAN, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

Micron Technology, Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 15–17, 19 and 20 of U.S. Patent No. 10,658,378 B2 (Ex. 1001, "the '378 patent"). Paper 1 ("Pet."). The Petition is supported by a declaration from Dr. Jack C. Lee. Ex. 1003 ("Lee Declaration"). Yangtze Memory Technologies Company, Ltd. ("Patent Owner") filed a Preliminary Response to the Petition. Paper 12 ("Prelim. Resp.").

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2023). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." For the reasons given below, on this record, Petitioner has established a reasonable likelihood that it would prevail in showing the unpatentability of claims 15–17, 19, and 20 of the '378 patent. Accordingly, we institute an *inter partes* review as to 15–17, 19, and 20 of the '378 patent on all asserted grounds of unpatentability.

B. Real Parties in Interest

Petitioner identifies itself and its subsidiaries, including Micron Consumer Products Group LLC, as real parties-in-interest. Pet. 5. Patent Owner identifies itself as a real party-in-interest. Paper 3, 2.

C. Related Matters

The parties represent that the '378 patent is involved in *Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc. and*

Micron Consumer Products Group, LLC, Case No. 3:23-cv-05792-RFL (N.D. Cal., filed November 9, 2023). Paper 3, 2; Pet. 4.

Petitioner also filed IPRs challenging other patents asserted in the district court cases, namely U.S. Patent Nos. 10,950,623 (IPR2024-00794), 10,861,872 (IPR2024-00789), 10,868,031 (IPR2024-00790), 10,937,806 (IPR2024-00791), 11,501,822 (IPR2024-00795), 11,468,957 (IPR2024–00792), and 11,600,342 (IPR2024-00793). Pet. 5–6.

D. The '378 Patent

The '378 patent is titled "Through Array Contact (TAC) For Three-Dimensional Memory Devices." Ex. 1001, code (54). The '378 patent issued from Application No. 16/047,182, filed on July 27, 2018, and is a continuation of PCT/CN/2018/085421, filed on May 3, 2018. *Id.* at code (63). The '378 patent relates to "a channel hole plug structure of three-dimensional (3D) memory devices." *Id.* at 1:32–33.

E. Illustrative Claim

Claim 15 is illustrative, and recites as follows:[1]

[15.PRE] A three-dimensional (3D) memory device, comprising:

[15.A] a substrate with an isolation structure;

[15.B] an alternating conductor/dielectric layer stack disposed on the substrate;

[15.C] a dielectric structure on the isolation structure and extending vertically through the alternating conductor/dielectric layer stack, wherein the alternating conductor/dielectric layer stack abuts a sidewall surface of the dielectric structure and the dielectric structure is formed of a dielectric material;

[1] Bracketed organization added as per the Petition.

[15.D] channel structures and slit structures extending vertically through the alternating conductor/dielectric layer stack;

[15.E] a staircase structure disposed in the alternating conductor/dielectric layer stack, wherein the staircase structure comprises levels with each level having a conductor layer thereon;

[15.F] a word line contact disposed on the conductor layer of the each level;

[15.G] local contacts disposed on the channel structures and the slit structures; and

[15.H] through array contacts (TACs) extending vertically through the dielectric and the isolation structures.

F. Evidence

Petitioner relies on the following patent document evidence.

Name	Patent Document	Exhibit
Toyama et al. ("Toyama")	US 2017/0179026 A1	1005
Mushiga et al. ("Mushiga")	US 10,354,980 B1	1006
Makala et al. ("Makala")	US 10,262,945 B2	1007

G. Prior Art and Asserted Grounds

Petitioner asserts that claims 15–17, 19 and 20 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
15–17, 19, 20	103[2]	Toyama
15–17, 19, 20	103	Mushiga

[2] We apply AIA 35 U.S.C. § 103 to the '378 patent because it was filed after, and never claimed the benefit of an effective filing date before, March 16, 2013. Petitioner also applies AIA §§ 102 and 103. *See* Pet. 2, 24–26.

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
15–17, 19, 20	103	Mushiga, Makala

II. ANALYSIS

A. Legal Standards

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter 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]." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of non-obviousness.[3] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art ("POSITA") at the critical time "would have had a bachelor of science degree in electrical engineering or a similar discipline, along with 2-3 years of professional experience working with (e.g., researching, designing, or teaching) NAND flash memory devices, or an equivalent level of skill, knowledge, and experience (e.g., an advanced degree may replace some of the professional experience)." Pet. 27 (citing Ex. 1003 ¶¶ 36–37). Petitioner further asserts that a POSITA "would also have been aware of and generally knowledgeable about semiconductor manufacturing and 3D NAND's

[3] Neither party presents evidence or arguments regarding objective evidence of non-obviousness at this stage.

structure, its component parts, how it operates, and how it is controlled." *Id.* Patent Owner does not provide any such assessment in its Preliminary Response. For purposes of this Decision, we adopt Petitioner's proposed level of ordinary skill, as it appears to be consistent with the specification of the '378 patent and the prior art of record.

C. Claim Construction

In an *inter partes* review, we construe a patent claim "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b)." 37 C.F.R. § 42.100(b). Under this standard, the words of a claim generally are given their "ordinary and customary meaning," which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Here, only Patent Owner sets forth any explicit claim construction. Pet. 27; Prelim. Resp. 11–12. Patent Owner argues that the term "through array contact (TAC)," occurring in claim 15, should be construed according to its plain and ordinary meaning, which according to Patent Owner is "a contact that goes through an array." Prelim. Resp. 12. Patent Owner points to the description in the '378 patent of TACs 126 going through "memory array structures" including "channel structures 122" or "an array of word line contacts [142]." *Id.* (citing Ex. 1001, Figs. 1A–C, 6:11–7:4). However, because Petitioner's assertions and our determination would be unaffected by its proposed construction, we need not construe this term for purposes of institution. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the

controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner and Patent Owner argue whether "a substrate with an isolation structure" as set forth in limitation [15.A] requires that the isolation structure be part of the substrate, or whether it may encompass a structure that fills an opening in the substrate. The parties also argue whether the claim limitation "a dielectric structure" set forth in limitation [15.C] must be a single structure or whether it may encompass multiple structures. We address these construction issues *infra* at Section II.D.2 of this decision. For the remainder of the claim limitations, we do not need to determine a particular construction, and instead construe the claims pursuant to § 42.100(b).

D. Obviousness over Toyama

Petitioner asserts that claims 15–17, 19, and 20 are unpatentable under 35 U.S.C. § 103 as obvious over Toyama in view of the knowledge of a person of ordinary skill in the art. Pet. 28–77. Patent Owner argues against this assertion. Prelim. Resp. 39–55.

Upon consideration of Petitioner's explanations and the totality of evidence in this current record, we are persuaded that Petitioner demonstrates a reasonable likelihood of prevailing in showing that claims 15–17, 19, and 20 are unpatentable under 35 U.S.C. § 103 as obvious over Toyama.

1. Toyama

Toyama is titled "Through-Memory-Level Via Structures For a Three-Dimensional Memory Device." Ex. 1005, code (54). Toyama relates to three-dimensional NAND memory devices, such as vertical NAND strings,

and describes four exemplary structures and modifications thereof. Ex. 1005 ¶¶ 4, 14–155; Prelim. Resp. 13. Pertinent to the instant proceeding, Toyama describes a "first exemplary structure," illustrated in Figures 1 through 17. *Id.* ¶¶ 14–48. The first exemplary structure is illustrated by Figure 11A:

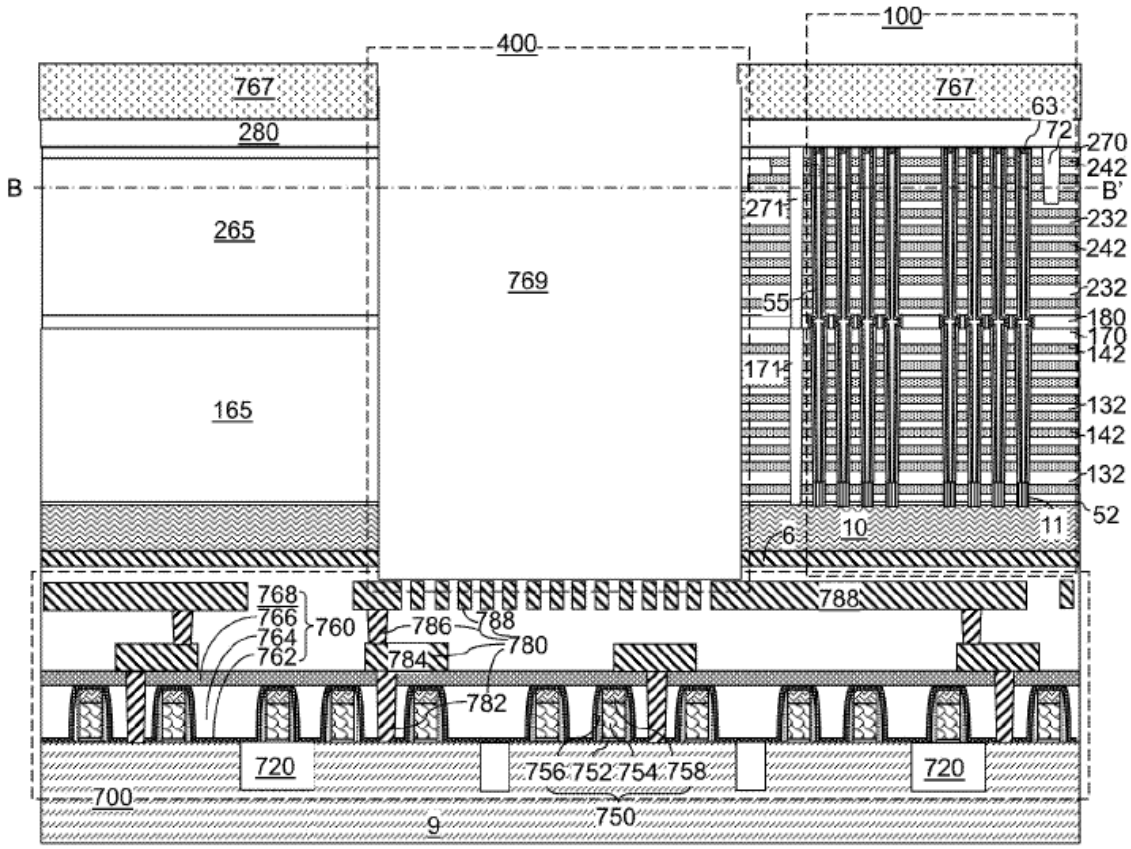

FIG. 11A

Figure 11A depicts semiconductor substrate 9 having semiconductor devices 710 formed thereon, with shallow trench isolation structures 720 providing electrical isolation therebetween. *Id.* ¶ 162. At least one dielectric layer 760 is formed over the semiconductor devices, and lower level metal interconnect structures 780 formed thereon to function as landing pads for through-memory-level via structures. *Id.* ¶ 164. Upon these structures in underlying peripheral region 700 (those having numbers in the 700s), a planar semiconductive layer 10 is formed. On semiconductor layer

10 is an alternating stack of conductive layers 146, 246 (replacing sacrificial material layers 142, 242) and insulating layers 132, 232. *Id.* ¶¶ 172, 196, 228. In portions of the alternating stack, supporting pillar structures 171 are formed, and other portions of the dielectric stack appear as a stepped region. *Id.* ¶ 182, Fig. 4B. In the stepped region, a through-memory-level opening 769 can extend from the top of the device down to the lower level metal interconnect structures 780 in peripheral region 700. *Id.* ¶ 213. A dielectric fill material portion is formed within each through-memory-level opening 769. *Id.* ¶ 216.

Toyama further describes a "second modification of [a] fourth exemplary structure," illustrated in Figures 44A through 49. Ex. 1005 ¶¶ 93–103. The "second modification" is illustrated by Figure 49:

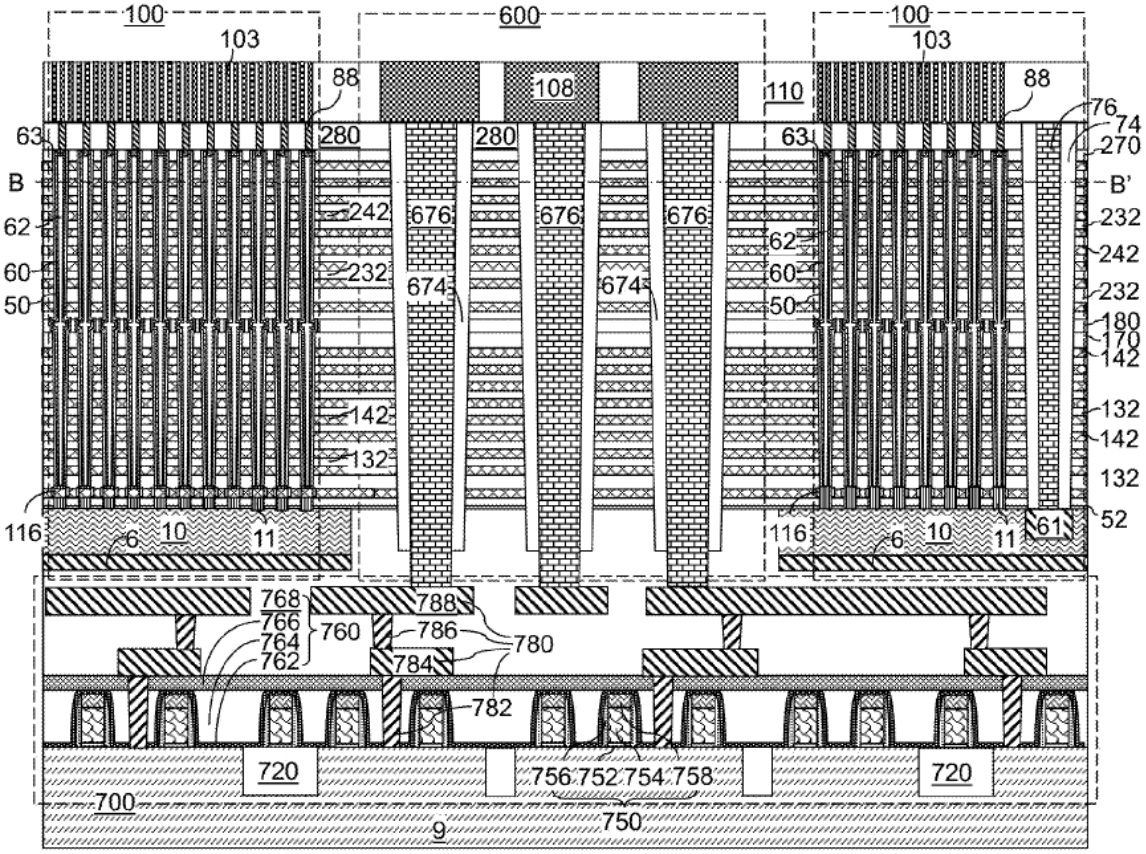

FIG. 49

Figure 49 depicts semiconductor substrate 9 having peripheral region 700, upon which planar semiconductive layer 10 is formed having an alternating stack of conductive layers 146, 246 (replacing sacrificial material layers 142, 242) and insulating layers 132, 232. *Id.* ¶¶ 310–311, 332. Multiple through-memory-level openings 676, surrounded by insulating liners 674, are created within the alternating stack. *Id.* ¶¶ 339–341.

2. Analysis of Claim 15

We begin our analysis of Petitioner's obviousness contentions with Petitioner's assertions as to claim 15.

> *[15.PRE] A three-dimensional (3D) memory device, comprising: [15.A] a substrate with an isolation structure;*

Petitioner asserts that limitations [15.PRE]–[15.A] are taught by Toyama, providing two alternate theories; the first based upon the "Second Modification" of Toyama's fourth exemplary structure, and the second based upon Toyama's "First Exemplary Structure."

a) "Second Modification" Alternative

In Petitioner's "Second Modification" alternative, Petitioner points to Toyama's description of a "3D memory device" that includes "substrate 10" that has an isolation structure in the form of insulating material filling opening 151. Pet. 28–31 (citing Ex. 1005, Figs. 17A, 44A, ¶¶ 173, 196, 277, 332; Ex. 1003 ¶¶ 93–94, 99–100). Petitioner annotates Figure 44A to illustrate:

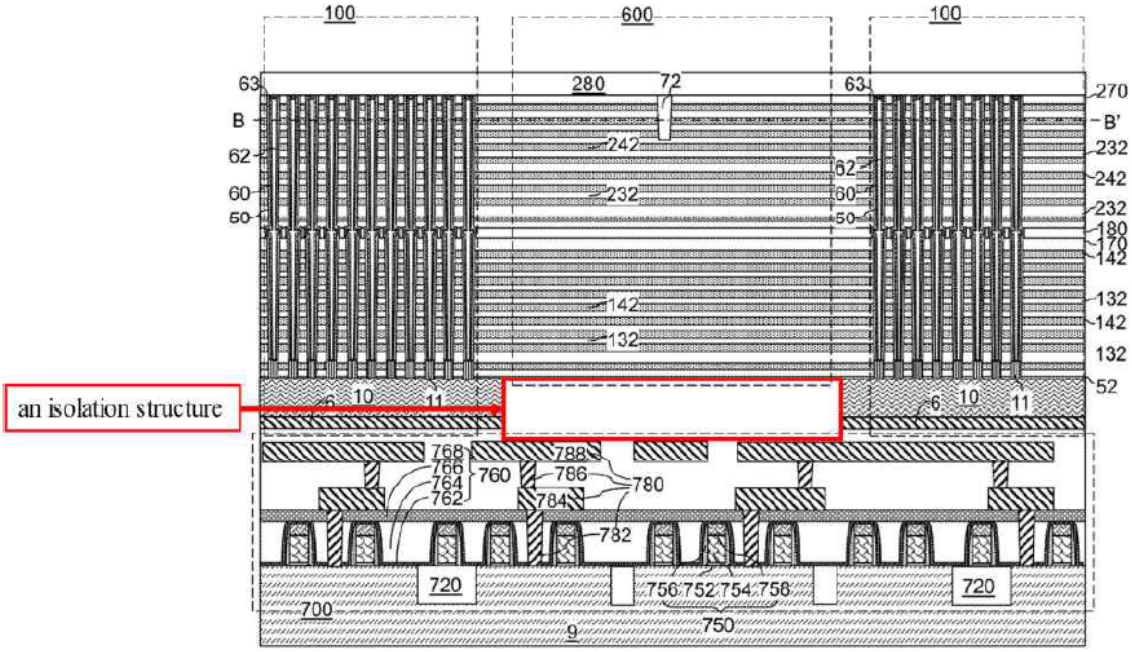

FIG. 44A

Petitioner's annotated Figure 44A displays a vertical cross-sectional view of a structure having an alternating stack of insulating layers and dielectric spacer layers formed over semiconductor substrate 9, with an annotated red box captioned as "an isolation structure" situated in the middle of layers 10 and 11. Ex. 1005 ¶ 332.

Patent Owner argues that Toyama does not teach a substrate with an isolation structure. Prelim. Resp. 49–52. Specifically, Patent Owner argues that the region of Toyama mapped by Petitioner to the "isolation structure" is located in a region of a cut through the alleged substrate, and is not part of the substrate required by claim 15. *Id.* at 49. Patent Owner argues that the '378 patent, through its descriptions and depictions, requires the isolation structure to be part of the substrate. *Id.* at 49–50 (citing Ex. 1001, Figs. 2, 4–13, 12:54–66, 20:38–42). Patent Owner argues that Toyama's insulating material layer 760 exists in a "through-opening" in the substrate, which has been completely removed in the relevant region, causing layer 760 to be in

"a region outside and merely abutting the alleged substrate." *Id.* at 50–51 (citing Ex 1004, Fig. 44A). Thus, Patent Owner argues, "there is no alleged substrate 'with' that 'insulating material layer 760.'" *Id.* at 51.

We determine that on the current record, Petitioner has shown Toyama's substrate having insulating layer 760 in an excavated portion of the substrate layer teaches the claimed "substrate with an isolation structure." Patent Owner's argument is unavailing because it does not appear to be supported by the '378 patent specification. Figure 2 of the '378 patent, upon which Patent Owner's argument rests, describes its isolation structure on the substrate as "STI structure is formed on a top portion of substrate 202 and filled with a dielectric material." Ex. 1001, 10:30–40; Prelim. Resp. 39–41. The '378 patent states "the term 'substrate' refers to a material onto which subsequent material layers are added, or otherwise 'disposed.'" Ex. 1001, 4:41–43. Thus, the '378 patent indicates that a substrate with an isolation structure may be a substrate with an isolation structure formed on a portion thereon, such as by adding material layers or otherwise disposing material on the substrate.

With regard to adding materials "on" the substrate, the '378 patent clarifies that "spatially relative terms are intended to encompass different orientations . . . in addition to the orientation depicted in the figures. The apparatus may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein may likewise be interpreted accordingly." Ex. 1001, 4:34–40, 10:36–39.

Taken together, these passages of the '378 patent indicate that for a substrate having additional layers or structures added or disposed thereon, such layers or structures could be considered part of, or "with" the substrate. These passages further indicate that a layer is disposed on the substrate if it

is on the substrate in any orientation, including by rotation of the device. Thus, although Figure 2 of the '378 patent shows its isolation structure to be on the substrate in both the vertical and horizontal directions (e.g., rotating Figure 2 by zero, +90, or -90 degrees), a structure will be considered to be on the substrate even if it is not on the substrate in the displayed orientation so long as it is on the substrate in any possible rotation.

Regarding Toyama, Patent Owner states that Toyama's dielectric fill 430 only "abut[s] the alleged substrate" 10, because "by forming 'opening 769,' Toyama creates a region outside and merely abutting the alleged substrate" 10. Prelim. Resp. 43. Toyama, however, teaches that opening 769 "extend[s] through" substrate 10, and that dielectric fill is "formed within" opening 769 "for example, by deposition." Ex. 1005 ¶¶ 213, 216. Thus, Toyama's dielectric fill is within, abuts, *and* is formed on substrate 10. Because "on" is not orientation-specific, opening 151 (filled with insulating material) is directly atop (and below) substrate 10 when Figure 12A is considered in an orientation rotated 90 degrees. Ex. 1005, Fig. 44A. Because Toyama's dielectric-filled opening 769 is located within, abuts, and is formed on, substrate 10, Toyama teaches the claimed "substrate with an isolation structure." Consequently, Petitioner has sufficiently shown that limitation [15.PRE], to the extent limiting, and limitation [15.A] are taught by Toyama's second modification of its fourth exemplary structure, on the current record for purposes of institution, notwithstanding Patent Owner's arguments to the contrary. The parties are invited to address this issue at trial.

b) "First Exemplary Structure" Alternative

Alternately, Petitioner asserts that Toyama's "first exemplary structure" teaches an isolation structure in the form of dielectric fill material

portion 430 "level with and below the top of" semiconductor material layer (substrate) 10. Pet. 31–36 (citing Ex. 1005, Figs. 10A–13A, ¶¶ 192–194, 213, 216; Ex. 1003 ¶¶ 102–103). Petitioner's annotated Figure 13A is reproduced below:

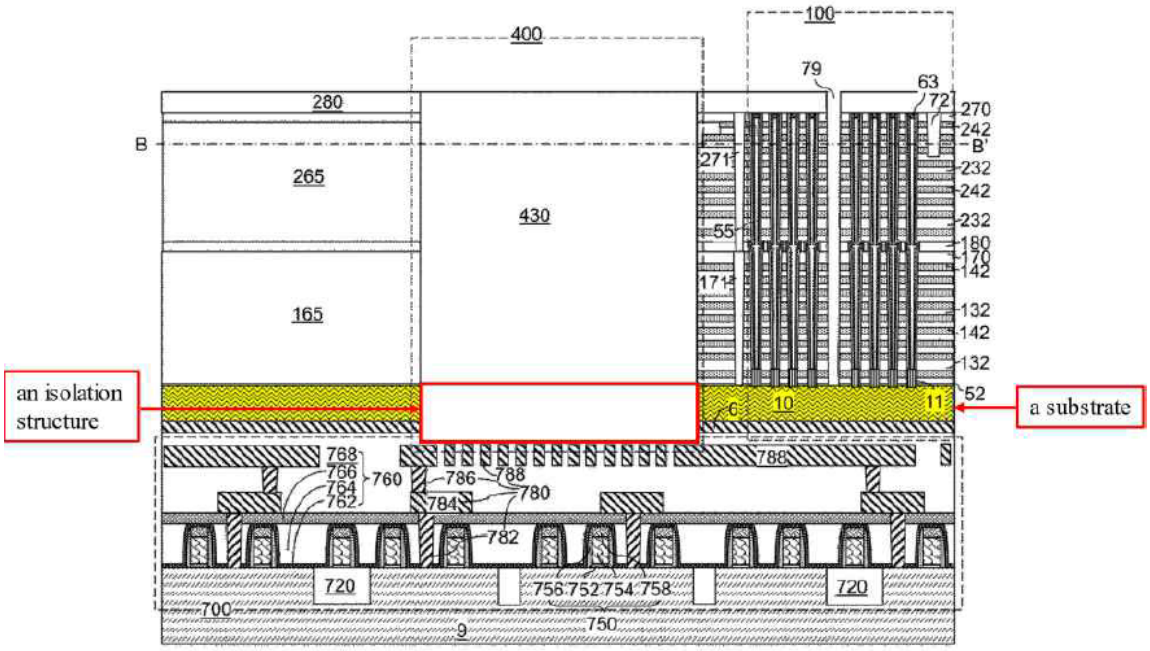

FIG. 13A

Petitioner's annotated Figure 13A depicts a dielectric fill material portion 430 formed within a through-memory opening 769 formed in through-memory level via regions 400, adjacent to memory array region 100 and word line contact via regions 200. Ex. 2005 ¶¶ 214, 216.

Patent Owner argues that Petitioner's asserted "isolation structure" is "located in the region of a cut through the alleged substrate, and is not part of the substrate as required by" claim 15, which recites "a substrate ***with*** an isolation structure." Prelim. Resp. 39 (citing Ex. 1001, claim 15). Patent Owner argues that the isolation structure is described in the '378 patent as being part of the substrate. *Id.* at 39–40 (quoting Ex. 1001, 12:54–66 (According to some embodiments, ***substrate 202 includes isolation regions***

or structures, like STI [Shallow Trench Isolation] structure 233"), 20:38-42 ("In some embodiments, a 3D memory device includes a semiconductor substrate, an alternating layer stack disposed on the semiconductor substrate, and a dielectric structure, extending vertically through the alternating layer stack, on ***an isolation region of the substrate***"), citing Figs. 2, 4–13).

Patent Owner argues that Petitioner's mapping requires Toyama's dielectric fill portion 430 to be arbitrarily subdivided into two parts, with the lower part only being labeled an isolation structure. *Id.* at 41. Patent Owner argues that even the arbitrarily selected lower portion of dielectric fill material portion 430 is not part of the substrate. *Id.* Patent Owner characterizes the identified region of dielectric fill material portion 430 as existing in "a region outside and merely abutting the alleged substrate"; i.e., a region "where the alleged substrate has been entirely removed" such that "there is no alleged substrate "with" that dielectric fill material." *Id.* at 43 (citing Ex. 1005, Figs. 12A, 13A, 14A, ¶¶ 213–215).

Patent Owner argues that none of Toyama's figures depict that dielectric fill material portion 430 is "surrounded" by other regions. *Id.* at 42, 44 (citing Ex. 1005, Figs. 1A–B to 17A–F). Patent Owner points to Toyama's Figure 12B as illustrating that the substrate is not divided into isolated portions, but remains connected, and therefore does not isolate[] portions of the substrate from one another as asserted by Petitioner. *Id.* at 44.

As determined in our discussion of the Second Modification, a substrate with an isolation structure may include a substrate having an abutting isolation structure, or an isolation structure "formed on" the substrate, in which "on" may be considered in any orientation of the device.

For Petitioner's First Exemplary Structure assertion, Toyama's dielectric fill material portion 430 is on substrate 10 because it abuts the substrate, and is formed on the substrate. Ex. 1005, "Sheet19" (Fig. 12A). Consequently, limitation [15.A], and on the current record for purposes of institution, is taught by Toyama's first exemplary structure.

Consequently, limitation [15.PRE], to the extent limiting, and limitation [15.A] are taught by Toyama's first exemplary structure, on the current record for purposes of institution.

> *[15.B] an alternating conductor/dielectric layer stack disposed on the substrate;*

Petitioner asserts that Toyama teaches an alternating conductor (146, 246)/dielectric (132, 232) stack disposed on substrate 10. Pet. 36–38 (citing Ex. 1005, Fig. 17A; Ex. 1003 ¶¶ 106–107). Patent Owner does not dispute this assertion at this juncture. Upon review of the current record, we determine that Petitioner's assertions regarding limitation [15.B] are supported by the record in a manner sufficient for institution.

> *[15.C] a dielectric structure on the isolation structure and extending vertically through the alternating conductor/dielectric layer stack, wherein the alternating conductor/dielectric layer stack abuts a sidewall surface of the dielectric structure and the dielectric structure is formed of a dielectric material;*

Petitioner asserts that Toyama teaches the claimed alternating conductor/dielectric stack of limitation [15.C] through Toyama's description of alternating layers of conductive layers (146, 246) and insulating layers (132, 232) which rest on semiconductor layer 10. Pet. 36–38 (citing Ex. 1005, Fig. 17A, ¶¶ 172, 190, 228, 232, 337; Ex. 1003 ¶¶ 106–108). Regarding the claimed "a dielectric structure on the isolation structure,"

Petitioner provides two alternative theories, based on Toyama's "Second Modification" and "First Exemplary Structure," respectively.

a) "Second Modification" Alternative

Petitioner asserts that Toyama teaches a dielectric structure in the form of multiple dielectric insulating liners 674 on an isolation structure in the form of the insulating material filling opening 151. *Id.* at 39–42 (citing Ex. 1005 ¶¶ 338–340, 233, 381; Ex. 1003 ¶ 111). Petitioner asserts that Toyama's alternating conductor/dielectric stack abuts a sidewall surface of dielectric liners 674, providing an annotated version of Figure 49 to illustrate this relationship:

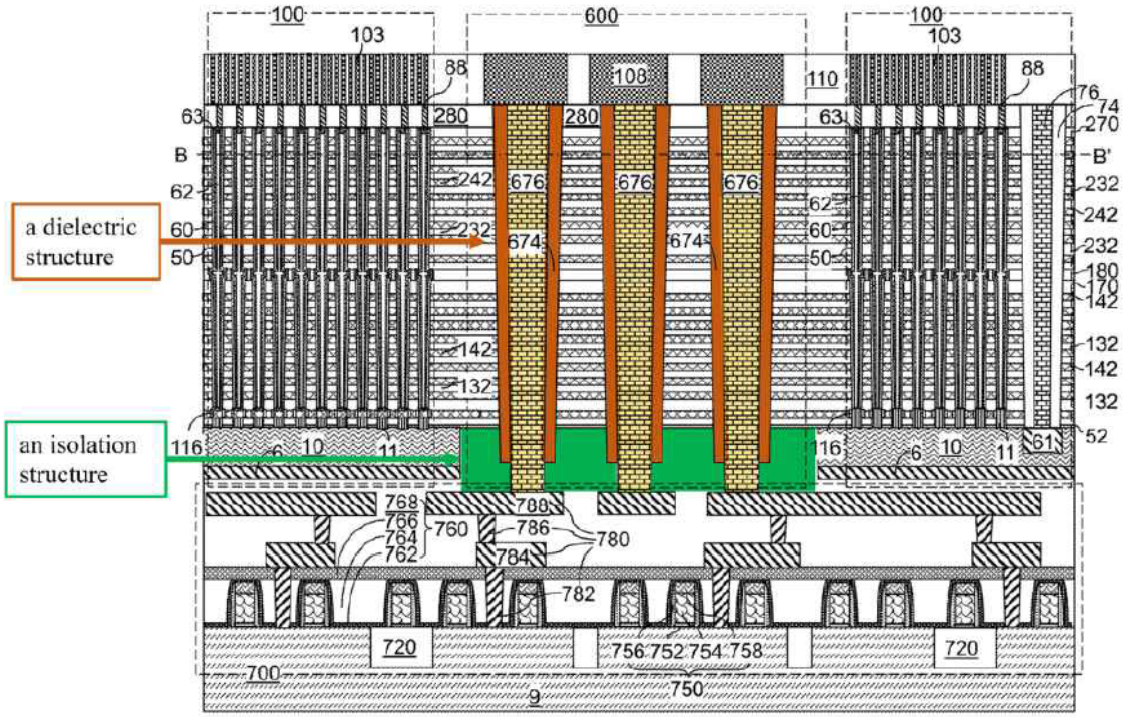

FIG. 49

Annotated Figure 49 depicts through-memory-level via structures 676 that are each laterally electrically isolated from electrically conductive layers (146, 246) by respective insulating liners 674. Ex. 1005 ¶ 380.

Petitioner asserts that the claim limitation "a dielectric structure" is taught by Toyama's multiple structures 676. Pet. 40–42. Petitioner argues that because all of the dielectric liners 674 were constructed together and have the same function, they meet a dictionary definition of "structure" as "something (as a building) that is constructed." *Id.* at 40–41 (citing Ex. 1005 ¶¶ 338–340; Ex. 1022, 5 (dictionary)). Petitioner further argues that the insulating liners 674 are collectively a single structure because "an indefinite article 'a' or 'an' in patent parlance carries the meaning of 'one or more' in open-ended claims containing the transitional phrase 'comprising.'" *Id.* at 41 (citing *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000)).

Patent Owner argues that Toyama's "Second Modification" does not disclose or render obvious an isolation structure, referring to its arguments against Petitioner's assertions for limitation [15.A]. Prelim. Resp. 52. However, for the same reasons discussed for limitation [15.A], we determine Petitioner has shown limitation [15.C] to be taught by Toyama's second modification of its fourth exemplary structure for purposes of institution, notwithstanding Patent Owner's arguments to the contrary.

b) "First Exemplary Structure" Alternative

Petitioner also asserts that Toyama's "first exemplary structure" illustrated in Figure 15A teaches limitation [15.C]. Pet. 45–54. Petitioner points to dielectric fill material portion 430 as represented in Figure 15A. Pet. 45. Petitioner points to a lower portion of dielectric fill material portion 430 as the claimed isolation structure and the upper portion of dielectric fill material portion 430 as the claimed dielectric structure. *Id.* at 46. Petitioner asserts that "[n]othing in the language of the claim requires forming the structures in different steps or of different materials, nor is there a clear

disavowal of such in the specification. On the contrary, the 378 Patent's disclosure expressly broadens 'isolation structure' beyond the disclosed embodiment." *Id.* (citing Ex. 1001, 10:34–35). Petitioner asserts that the dielectric structure in both Toyama and the '378 patent have the same purpose – "to electrically insulate a 'through array contact' as it extends through" a device portion. *Id.* at 46–47 (citing Ex. 1001, 11:12–14; Ex. 1003 ¶ 120). Petitioner cites to *Retractable Technologies, Inc. v. Becton, Dickinson & Co.* for the proposition that different parts of the same structure can meet distinct claim elements. *Id.* at 47 (citing *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1303–04 (Fed. Cir. 2011)). Petitioner further points to a separate embodiment in Toyama that describes forming the isolation structure and dielectric structure separately. *Id.* (citing "Toyama's third exemplary structure"); Ex. 1003 ¶ 99 (citing Ex. 1005 ¶ 277). Petitioner further asserts that such a separate formation of the two portions of the dielectric fill material portion 430 would constitute the mere substitution of a known process ("Toyama's third exemplary structure" formation) for another process ("Toyama's first exemplary structure" formation) to obtain predictable results (the insulating material layer filling opening 151 to electrically isolate the conductors embedded within). *Id.* at 47–48 (citing Ex. 1003 ¶ 121). Dr. Lee points to a statement in Toyama that its second modification "can be formed concurrently with the formation of any of the first, second, and third exemplary structures." Ex. 1003 ¶ 98.

Patent Owner argues that Petitioner has not shown Toyama to teach the claimed isolation structure, referencing its arguments for limitation [15.A]. Prelim. Resp. 45. We find this argument unavailing for the same reasons explained with respect to limitation [15.A]. *Supra* at § II.D.2.

Patent Owner also argues that the ’378 patent contemplates the isolation structure being part of the substrate, and that the dielectric structure is a separate structure from, and disposed on, the isolation structure, unlike Toyama’s unitary structure. Prelim. Resp. 45–46. Patent Owner argues that *Retractable Technologies* is inapposite because that case involved clear claim language conveying that the structures could be part of one another, and the specification in that case suggested that they could be formed integrally. *Id.* at 47 (citing *Retractable Techs.*, 653 F.3d at 1303). Patent Owner argues that no such statements suggesting integral formation are present in the ’378 patent’s claims or specification. *Id.* Patent Owner further argues against Petitioner’s assertions as being an arbitrary division of a single dielectric structure into two separate features of the challenged claims. *Id.* at 44–45.

Patent Owner’s argument is unavailing at this stage of the proceeding. Neither the claim nor the specification of the ’378 patent requires different materials or separate depositions for the isolation structure and the dielectric structure thereon. *See* Ex. 1001, 10:35–36 (“dielectric structure 232 is in contact with STI [shallow trench isolation] structure 233”), 10:37–40 (isolation structure 233 filled with SiO_2), 10:46–47 (dielectric structure can include SiO_2). Dielectric fill material portion 430 performs the isolation functions of both the isolation structure and the dielectric structure. Pet. 46–47; *see* Prelim. Resp. 44–48; Ex. 1005 ¶ 160 (“As used herein, an ‘insulating material’ or a ‘dielectric material’ refers to a material having electrical conductivity less than 1.0×10^{-6} S/cm”). Thus, Petitioner sufficiently shows at this stage of the proceeding that dielectric fill material portion 430 can be considered as both the isolation structure and the dielectric structure thereon.

With respect to Petitioner's asserted combination of embodiments from Toyama, Patent Owner argues that the Toyama's other relied-upon embodiment lacks additional limitations. Prelim. Resp. 48 (referencing its arguments for the second modification at "§VI.A.2.a").[4] However, Patent Owner's argument is unavailing at this stage of the proceeding for the same reasons explained with respect the second modification and limitation [15.A]. Moreover, because Petitioner has shown that Toyama contemplates that its third exemplary embodiment, having separately-formed dielectric and isolation structures, may be combined with its first exemplary embodiment, and its third exemplary embodiment describes a step of filling a substrate-level opening 151 with dielectric material, we determine that Petitioner sufficiently shows that Toyama teaches separate portions of its dielectric fill, corresponding to an isolation structure within and abutting the substrate, and a dielectric structure formed thereon.

Upon review of the current record, we determine that Petitioner's assertions regarding limitation [15.C] are supported by the record in a manner sufficient for institution.

> *[15.D] channel structures and slit structures extending vertically through the alternating conductor/dielectric layer stack; [15.E] a staircase structure disposed in the alternating conductor/dielectric layer stack, wherein the staircase structure comprises levels with each level having a conductor layer thereon; [15.F] a word line contact*

[4] Patent Owner refers to "§ VI.A.2.a," which does not exist. § VI.A points back to its arguments for discretionary denial. We treat this as a reference to § VII.A.2.a, which argues that Toyama's second modification does not teach a substrate with an isolation structure as set forth in limitation [15.A].

disposed on the conductor layer of the each level; [15.G] local contacts disposed on the channel structures and the slit structures;

Petitioner asserts that Toyama's first exemplary modification teaches channel structures ("memory stack structures 55") extending vertically through the alternating conductor/dielectric stack, slit structures ("laterally-elongated contact via structures 76") in the alternating conductor/dielectric stack (Fig. 17A), a staircase structure in the alternating stack having levels with each level having a conductive layer (146, 246) thereon (Fig. 17C), word line contact ("word line contact via structures 86") disposed on conductive layers (146, 246) (Fig. 17C), local contacts ("drain contact via structures 88") disposed on channel structures ("memory stack structures 55"), and local contacts ("source connection via structures 91") disposed on the slit structures (Figure 17A). Pet. 55–62. Petitioner asserts that Toyama's second modification teaches these limitations for the same reasons. Pet. 56 (citing Ex. 1005, Fig. 49; Ex. 1003 ¶ 132), 59 (citing Ex. 1005, Fig. 49; Ex. 1003 ¶ 136), 60–61 (citing Ex. 1005 ¶¶ 243, 322, ¶ 322; Ex. 1003 ¶ 138), 62–63 (citing Ex. 1005 ¶ 322; Ex. 1003 ¶¶ 141–142). Patent Owner does not contest these assertions at this juncture. Prelim. Resp.

Upon review of the current record, we determine that Petitioner's assertions regarding limitations [15.D], [15.E], [15.F], and [15.G] are supported by the record in a manner sufficient for institution.

[15.H] through array contacts (TACs) extending vertically through the dielectric and the isolation structures.

In its "Second Modification" theory, Petitioner asserts that Toyama's through-memory-level via structures 676 teach the claimed TACs, and that they extend vertically through insulating liners 674 (isolation structures) and

the insulating material layer filling opening 151. Pet. 66–68 (citing Ex. 1005, Fig. 49, ¶¶ 341–342; Ex. 1003 ¶ 149).

Patent Owner argues that Toyama does not teach multiple TACs extending through the same dielectric structure. Prelim. Resp. 53–55. Patent Owner argues that Petitioner mapped multiple insulating liners 674 to a single dielectric structure. *Id.* at 53 (citing Pet. 41).

We are persuaded by Petitioner's showing. Patent Owner's argument that the claim requires a single dielectric structure with multiple TACs extending therethrough does not appear consistent with the claim language. Limitation [15.H] requires TACs (multiple) extending through "the dielectric and the isolation structures" (multiple). Being plural, the phrase "the dielectric and the isolation structures" is not limited to a single dielectric and a single isolation structure; it may include multiple dielectric structures and/or multiple isolation structures. Moreover, the specification of the '378 patent is consistent with a single TAC extending through a single respective dielectric structure. Ex. 1001, 21:17–25 ("form a dielectric structure as a TAC region" and "removing portions of the dielectric structure and the isolation structure" and filling those portions "to form a TAC structure in the TAC region"). Thus, Toyama's Figure 49, which shows multiple TACs extending through vertically respective dielectric structures (liners 674) and a single isolation structure (filler 151), meets the language of limitation [15.H]. Ex. 1005, Fig. 49. Upon review of the current record, we determine that Petitioner's assertions regarding limitation [15.H] based upon Toyama's second modification of the fourth exemplary structure are supported by the record in a manner sufficient for institution.

In its "First Exemplary Structure" assertions, Petitioner asserts that Toyama's "through-memory-level via structures 488" are through array

contacts (TACs), and that they extend vertically through dielectric material fill portion 430 (dielectric structure and isolation structure). Pet. 68–70.

Patent Owner argues that Petitioner has not shown Toyama teaches or renders obvious the isolation structure or a dielectric structure on the isolation structure, referring to its arguments against limitations [15.A] and [15.C]. Prelim. Resp. 48.

However, Patent Owner's argument is unavailing for the same reasons explained with respect to limitations [15.A] and [15.C]. Upon review of the current record, we determine that Petitioner's assertions regarding limitation [15.H] based upon Toyama's first exemplary structure are supported by the record in a manner sufficient for institution.

Conclusion

For the foregoing reasons, Petitioner has demonstrated a reasonable likelihood that it will prevail on showing that claim 15 is obvious over Toyama.

3. Analysis of Claims 16, 17, 19, and 20

Patent Owner does not specifically contest Petitioner's assertions as to claims 16, 17, 19, and 20; however, the burden of proving unpatentability rests solely upon Petitioner. We have reviewed Petitioner's assertions for these claims. Pet. 72–77. Upon review of these assertions, we determine that they are supported by the record such that Petitioner has demonstrated, by a reasonable likelihood, the unpatentability of claims 16, 17, 19, and 20 over Toyama.

E. Obviousness over Mushiga

Petitioner asserts that claims 15–17, 19 and 20 are obvious over Mushiga. Pet. 77–102. Patent Owner argues against these assertions. Prelim. Resp. 55–67.

1. Mushiga

Mushiga is titled "Three-Dimensional Memory Device Containing Bonded Chip Assembly With Through-Substrate Via Structures and Method of Making Same." Ex. 1006, code (54). Mushiga relates to bonded semiconductor chip assemblies for three-dimensional NAND flash memory that have through-substrate via structures. Ex. 1006, 1:9–20.

2. Analysis of Claim 15

We begin our analysis of Petitioner's obviousness contentions with Petitioner's assertions as to claim 15.

> *[15.PRE] A three-dimensional (3D) memory device, comprising: [15.A] a substrate with an isolation structure;*

Petitioner asserts that limitations [15.PRE]–[15.A] are taught by Mushiga's "three-dimensional monolithic memory array devices," including substrate 8 having an isolation structure in the form of insulating material liners 302 and backside insulating layer 306. Pet. 77–80. Petitioner asserts that the '378 patent defines a "substrate" as "a material onto which subsequent material layers are added, or otherwise 'disposed.'" *Id.* at 78 (citing Ex. 1001, 4:41–43). Petitioner asserts that insulating liners 302 and layer 306 isolate various conductive components from the substrate, and therefore, are an isolation structure. *Id.* at 79. Petitioner further asserts that the substrate is "with an isolation structure" because parts of the substrate were removed to form the liners 302 and layer 306. *Id.* at 90 (citing Ex. 1003 ¶¶ 173–174).

Referring to its reasoning in addressing Petitioner's assertions for limitation [15.A] under the Toyama ground, Patent Owner argues that at least Mushiga's liners 302 are not part of the substrate because they fill a cut

through the substrate. Prelim. Resp. 58–59. Patent Owner argues that liners 302 are thus "outside and merely abutting the alleged substrate." *Id.* at 59.

As discussed at § II(D)(2), Figure 2 of the '378 patent describes its isolation structure on the substrate as being "formed on a top portion of substrate 202 and filled with a dielectric material." Ex. 1001, 10:30–40. For the same reasons as discussed at § II(D)(2), we determine for purposes of institution that a material that fills a volume formed on a portion of the substrate meets limitation [15.A]. Consequently, Petitioner has shown, for purposes of institution, that Mushiga teaches limitations [15.A], and to the extent limiting, limitation [15.PRE], notwithstanding Patent Owner's arguments to the contrary.

[15.B] an alternating conductor/dielectric layer stack disposed on the substrate;

Petitioner asserts that limitation [15.B] is taught by Mushiga's stack 600, which is composed of an "alternating stack of insulating layers (132, 232) and electrically conductive layers (146, 246)" disposed on substrate 9. Pet. 80 (citing Ex. 1006, Fig. 11, 8:67–9:2). Petitioner further asserts that the stack is "on" the substrate under the definition of "on" provided by the '378 patent; i.e., that "'on' not only means 'directly on' something but also includes the meaning of 'on' something with an intermediate feature or a layer therebetween." *Id.* at 80–81 (citing Ex. 1001, 4:20–25). Patent Owner does not explicitly contest this assertion. Prelim. Resp.

We have reviewed the current record and determine that it supports Petitioner's assertions, and that Mushiga teaches limitation [15.B].

[15.C] a dielectric structure on the isolation structure and extending vertically through the alternating conductor/dielectric layer stack, wherein the alternating conductor/dielectric layer stack abuts a

sidewall surface of the dielectric structure and the dielectric structure is formed of a dielectric material;

Petitioner asserts that the claimed dielectric structure is taught by Mushiga's insulating material layer 760, dielectric material portion 165, dielectric layer 180, dielectric material portion 265, and insulating spacer 586, considered collectively. Pet. 81–82 (citing Ex. 1006, Fig. 11; Ex. 1003 ¶ 177). Petitioner provides an annotated version of Figure 11:

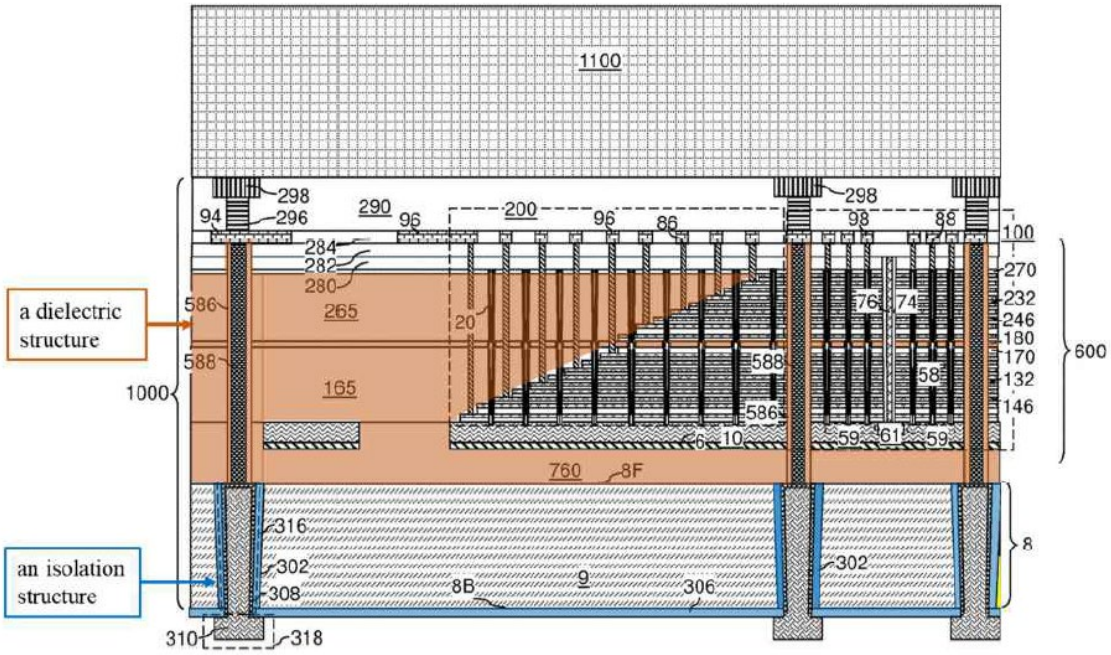

FIG. 11

Annotated Figure 11 depicts in orange a "dielectric structure" comprising insulating material layer 760, dielectric material portion 165, dielectric layer 180, dielectric material portion 265, and insulating spacer 586, and in blue, "an isolation structure" comprising insulating material liners 302 and backside insulating layer 306, with substrate 8 residing therebetween. *Id.* at 82.

Petitioner argues that "because these components together are something "that is constructed," they are a structure. *Id.* at 82–83 (citing Ex. 1022, 5 (Merriam-Webster definition of "structure" as "something ([such] as a building) that is constructed"); Ex. 1003 ¶ 179). Petitioner asserts that at least one element of the structure, layer 760, is directly on the isolation structure (elements 302, 306). *Id.* at 83. Petitioner further points to the description in the '378 patent that "on" includes "'on something with an intermediate feature or layer therebetween." *Id.* (citing Ex. 1001, 4:20–29, Ex. 1003 ¶ 180). Petitioner further asserts that Mushiga's dielectric structure extends through the dielectric stack, and that the dielectric stack abuts a sidewall surface of the dielectric structure. *Id.* at 83–85 (citing Ex. 1006, Fig. 11; Ex. 1003 ¶ 181). Petitioner further asserts that Mushiga's elements 760, 165, 180, 265, and 586 are described as being formed of a dielectric material, because Mushiga expressly discloses that each of these elements are insulating and/or dielectric. *Id.* at 85–86 (citing Ex. 1003 ¶ 184).

Patent Owner argues that the only alleged dielectric structure that extends through the stack; i.e., insulating spacers 586, is not also "on the isolation structure." Prelim. Resp. 60–62. Patent Owner argues that these spacers are not "on" Petitioner's alleged isolation structure of insulating layer 306 and insulating material liners 302. *Id.* at 62–63 (citing Ex. 1006, Fig. 11). Patent Owner argues that Petitioner's grouping of Mushiga's components in its alleged dielectric structure "has not discernable logic" and that each of those components "have distinct locations and roles compared to the '378's dielectric structure," and "omitted other adjacent dielectric elements [elements 270, 280, 282, 284, 290] that, if included, would have hurt its claim mapping." *Id.* at 63–66 (citing Ex. 1006, Fig. 11). Patent

Owner further points to its arguments against "isolation structure" in limitation [15.A], and the requirement for plural TACs extending through the dielectric and isolation structures as presented against Petitioner's assertions for limitation [15.C] based on Toyama. *Id.* at 61, 63.

However, as we have explained *supra*, we find Patent Owner's arguments against Petitioner's alleged isolation structure unavailing with respect to limitation [15.A] and we find unavailing Patent Owner's arguments against Petitioner's Toyama-based assertions with respect to limitation [15.C]. *Supra* § II(D)(2).

Further, we agree with Petitioner that in view of the disclosure of the '378 patent, "on" does not require direct contact, but includes components having an intervening material, and is not limited to any particular orientation (i.e., not limited to being vertically atop). *Supra* § II(D)(2). Consequently, because Mushiga's Figure 11 shows at least spacers 586 being "on" isolation structure 302, 306 through intervening material (such as substrate 9 and/or element 310), Petitioner has shown that Mushiga teaches a dielectric structure (including 586) that extends through the dielectric stack and is on the isolation structure 302, 306.

Moreover, Patent Owner's argument that Petitioner has selectively chosen only some dielectric elements as its dielectric structure is unavailing. We do not discern any requirement in the claims or the disclosure of the '378 patent that would prevent the claimed dielectric structure from being taught by multiple elements having different purposes. Although not providing a definition of "structure," the '378 patent broadly defines "layer" as a "material portion including a region with a thickness" that may have a "homogeneous or inhomogeneous continuous structure." Ex. 1001, 4:51–58. Thus, although Petitioner's selected disparate elements in its asserted

dielectric structure have an inhomogeneous continuous structure, in view of the description in the ’378 patent and the provided dictionary description we agree with Petitioner that they teach the claimed dielectric structure. Further, the components of Petitioner’s alleged dielectric structure each possess a dielectric quality such that their selection as a “dielectric structure” is, on the current record, supported by a reasonable explanation.

Consequently, Petitioner has shown, for purposes of institution, that Mushiga teaches limitation [15.C].

> *[15.D] channel structures and slit structures extending vertically through the alternating conductor/dielectric layer stack; [15.E] a staircase structure disposed in the alternating conductor/dielectric layer stack, wherein the staircase structure comprises levels with each level having a conductor layer thereon; [15.F] a word line contact disposed on the conductor layer of the each level; [15.G] local contacts disposed on the channel structures and the slit structures;*

Petitioner asserts that the claimed channel structures and slit structures are taught by Mushiga’s memory stack structures 58 and backside contact via structures 76, respectively. Pet. 86–90 (citing Ex. 1006, Fig. 11, 9:2–5, 10:1–18; Ex. 1003 ¶¶ 186–193; Ex. 1022, 4). Petitioner asserts that the claimed staircase structure is taught by the stepped surfaces of Mushiga’s alternating conductor/dielectric layer stack. *Id.* at 91–92 (citing Ex. 1006, Fig. 11; Ex. 1003 ¶ 194). Petitioner asserts that Mushiga teaches the claimed word line contact by its word line contact via structures 86 disposed on electrically conductive layers 146, 246. *Id*. at 92–93 (citing Ex. 1006, Fig. 11, 10:21–27; Ex. 1003 ¶ 196). Petitioner asserts that Mushiga teaches the claimed local contacts disposed on the channel structures and the slit structures by its drain contact via structures 88 in contact with and extending above memory stack structures 58. *Id.* at 94 (citing Ex. 1006, Fig. 11, 10:21–27). Petitioner further asserts that it would have been obvious to

dispose contacts on the backside contact via (slit) structures 76 because they serve as the source connection for memory stack structures, and would obviously find useful local contacts to provide a top-level electrical connection to the source. *Id.* at 95–98 (citing Ex. 1006, 10:16–18; Ex. 1003 ¶¶ 199–203; Ex. 1015, 110, 150; Ex. 1016, 275, 288).

We reviewed the current record and determine that it supports Petitioner's assertions, and that Mushiga teaches limitations [15.D], [15.E], [15.F], and [15.G].

> *[15.H] through array contacts (TACs) extending vertically through the dielectric and the isolation structures.*

Petitioner asserts that Mushiga teaches limitation [15.H] as illustrated in its annotated Figure 11 of Mushiga:

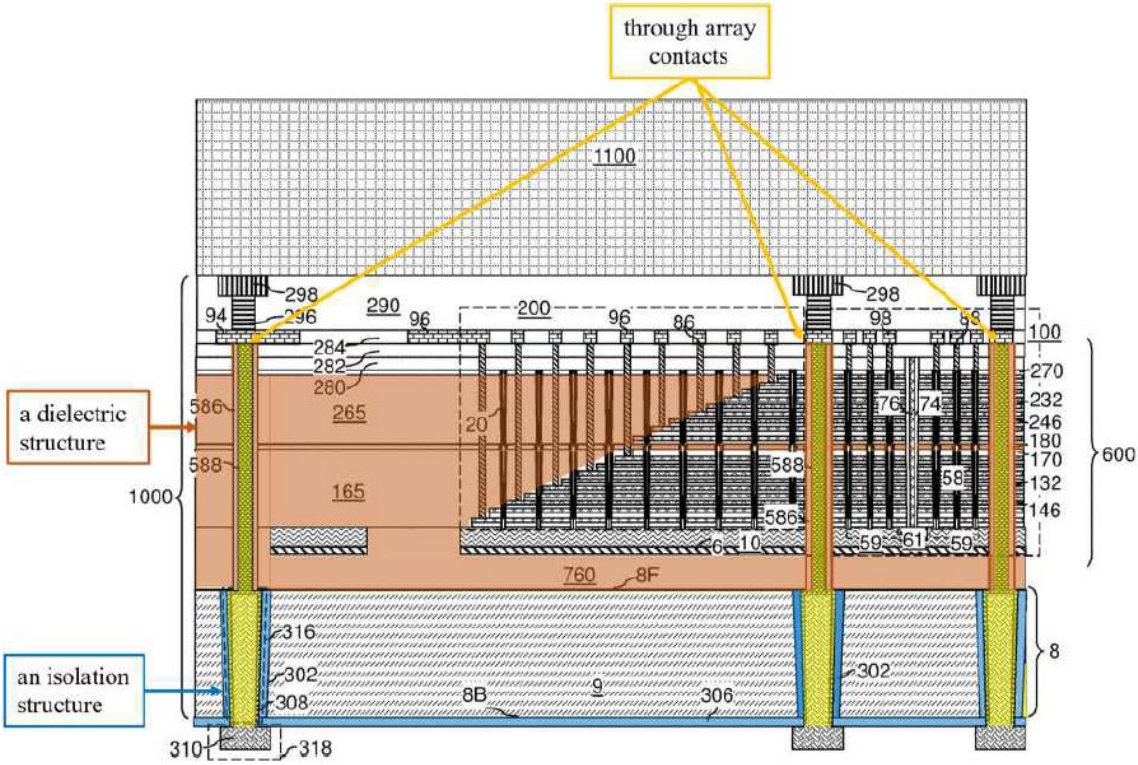

FIG. 11

Figure 11 depicts three through-memory-level via structure 588 and three adjoining through-substrate via structure 316, colored yellow and labeled

"through array contacts," elements 760, 165, 180, 265, and 586, colored orange and labeled "a dielectric structure," and elements 302, 316, colored blue and labeled "an isolation structure." Pet. 98 (citing Ex. 1006, Fig. 11, 10:31–57; Ex. 1003 ¶ 204.

Patent Owner argues that Petitioner's dielectric structure is the result of an improper combination, and that if only the insulating spacers 586 are considered, Mushiga's alleged TACs do not extend through the same dielectric structure. Prelim. Resp. 67.

We find Patent Owner's argument unavailing for the reasons discussed with respect to Patent Owner's argument that limitation [15.C] is not taught because Petitioner improperly combined distinct elements of Mushiga. *Supra* § II(E)(2).

Conclusion

For the foregoing reasons, Petitioner has demonstrated a reasonable likelihood that it will prevail on showing that claim 15 is obvious over Mushiga.

3. Analysis of Claims 16, 17, 19, and 20

Patent Owner does not specifically contest Petitioner's assertions as to claims 16, 17, 19, and 20; however, the burden of proving unpatentability rests solely upon Petitioner. We have reviewed Petitioner's assertions for these claims. Pet. 99–102. Upon review of these assertions, we determine that they are supported by the record such that Petitioner has demonstrated, by a reasonable likelihood, the unpatentability of claims 16, 17, 19, and 20 over Mushiga.

F. Obviousness over Mushiga and Makala

Petitioner advances its obviousness assertions in this ground by adding Makala to teach local contacts disposed on the slit structures.

Pet. 102–103. Patent Owner asserts Petitioner's arguments for its Mushiga and Makala ground fail for at the least the same reasons provided regarding Petitioner's Mushiga-only ground. At this stage of the proceedings, we find that Petitioner sufficiently establishes that Mushiga teaches this limitation for purposes of institution and therefore, we need not reach this ground for purposes of institution.

III. DISCRETION UNDER 35 U.S.C. § 325(D)

Patent Owner argues that the Board should exercise its discretion to deny institution under 35 U.S.C. § 325(d). Prelim. Resp. 19. Patent Owner provides two reasons in support; first, that Toyama was previously presented to the Office and the Examiner did not err in declining to issue a patent over it, and second, that Mushiga and Makala provide substantially the same teachings as Toyama. *Id.* at 19–36.

A. Toyama

1. Parties' Arguments

Patent Owner argues that Toyama was previously presented to the USPTO during prosecution. Prelim. Resp. 21–22 (citing Ex. 1002, 555). Patent Owner points to the Examiner's consideration of Toyama as indicated by the Examiner's signature on an information disclosure statement listing Toyama. *Id.* at 22 (citing Ex. 1002, 593). Patent Owner points out that Toyama was the only reference cited on that particular information disclosure statement. *Id.*

Petitioner admits that the Examiner previously considered Toyama, but erred by overlooking Toyama's disclosures and failing to reject the claims in light of Toyama. Pet. 10. Petitioner notes that the Examiner never discussed Toyama or its teachings. *Id.* Petitioner assigns significance to the fact that the Examiner received Toyama only after the Examiner indicated

allowability, and that the Patent Owner never notified the Examiner of a rejection that was issued by the Chinese Patent Office based upon Toyama. *Id.* at 11–12. Petitioner further asserts that the Chinese Patent Office's rejection of claim 17[5], and the reasoning in support of that rejection, was not provided to the Examiner. *Id.* at 12–13. Petitioner argues that its ground in this proceeding relies upon Toyama for the same structures that the Chinese Patent Office found Toyama teaches with respect to claim 17. *Id.* at 13–15. Petitioner argues that this lack of disclosure, and the determination by the Chinese Patent Office (confirmed upon internal appeal), indicates that the Examiner erred in overlooking those teachings when issuing the '378 patent. *Id.* at 15.

In response, Patent Owner argues that Toyama's deficiencies are not limited to those claim limitations addressed by Petitioner in its assertions. Prelim. Resp. 31–35. Patent Owner argues that Toyama discloses a "fabrication technique that the '378 criticizes and improves upon," including the formation of TACs "in a dielectric structure that is formed on an isolation structure of a substrate." *Id.* at 32 (citing Ex. 1001, Fig. 2, 5:35–39, 10:59–66, 18:27–41, 20:9–16). With respect to the determination of unpatentability by the Chinese Patent Office, Patent Owner argues that Chinese law applies a different legal standard and did, in fact, find the claims had distinguishing features from Toyama, in the form of the TACs that extend through a dielectric structure that is on an isolation structure of a substrate. *Id.* at 35–36 (citing Ex. 1012, 1014). Patent Owner argues that the evidence in the record indicates that Toyama's teachings lack key

[5] Petitioner asserts that the claim rejected by the Chinese Patent Office was "materially identical" to original U.S. claim 17.

inventive features of the ’378 patent application, and that the Examiner recognized this fact. *Id.* at 36.

2. Analysis under Becton, Dickinson factors

In evaluating whether to exercise our discretion under § 325(d), we weigh the following non-exclusive factors: (a) the similarities and material differences between the asserted art and the prior art involved during examination; (b) the cumulative nature of the asserted art and the prior art evaluated during examination; (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection; (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art; (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of prior art or arguments. *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential).

As discussed above, it is undisputed that Toyama was submitted to the examiner, thus satisfying factors (a) and (b) in favor of exercising our discretion to deny institution. The parties differ on the extent to which Toyama was evaluated during examination, but both agree that (1) Toyama was indicated by the Examiner on an Information Disclosure Statement as having been considered and (2) the Examiner did not detail any such consideration, in a rejection or otherwise in an Office action or other document of record. Thus, factor (c) weighs somewhat, but less than fully, in favor of exercising our discretion to deny institution.

Regarding factor (d), it is undisputed that no arguments regarding Toyama were presented during prosecution. Thus, the arguments made by the parties in the Petition and Preliminary Response were not presented previously to the Office, and factor (d) weighs against exercising our discretion to deny institution.

Regarding factor (e), Petitioner argues that during prosecution, the Examiner had indicated allowability of dependent claim 17 over the references applied to reject its independent claim. Pet. 11. Petitioner argues that the limitations of claim 17 were incorporated into the independent claims so as to secure allowance of the application and issuance of the '378 patent. *Id.* at 11, 13. Petitioner argues that these limitations added to secure allowance are "a staircase structure, a word line contact, and a local contact disposed on each channel structure and slit structure." *Id.* at 11 (emphasis omitted). Petitioner asserts that Toyama teaches each of these limitations. *Id.* at 13. Petitioner asserts that the claimed "staircase structure disposed in the alternating conductor/dielectric layer stack wherein the staircase structure comprises levels with each level having a conductor layer thereon" is taught by Toyama's alternating stack (132, 146, 232, 246) having electrically conductive layers (146, 246). *Id.* Petitioner asserts that the claimed "a word line contact disposed on each conductor layer of the staircase structure" is taught by Toyama's word line contact via structures 86 disposed on first and second conductive layers (146, 246). *Id.* Petitioner asserts that the claimed "a local contact disposed on each channel structure" is taught by Toyama's drain contact via structures 88 disposed on memory stack structures 55. *Id.* Petitioner asserts that the claimed "a local contact disposed on each slit structure" is taught by Toyama's source connection via structures 91 disposed on laterally-elongated contact via structures 76. *Id.*

Patent Owner argues that Petitioner's argument focuses only on the limitations incorporated from dependent claim 17 but fails to discuss other limitations that are missing from Toyama. Prelim. Resp. 31–32. Patent Owner argues that Toyama lacks a teaching of TACs formed in a dielectric structure that is formed on an isolation structure of a substrate, which results in a less complex and less costly fabrication technique. *Id.* at 32–35 (citing Ex. 1001, 5:35–39, 10:59–66, 18:27–41, 20:9–16).

Based on the arguments presented, we determine that the Office erred in its evaluation of Toyama. Patent Owner argues that Toyama lacks teaching of TACs formed in a dielectric structure that is formed in an isolation structure of a substrate. Prem. Resp. 32–35. However, Patent Owner does not argue that the Office did not find such a teaching present in the prior art applied during prosecution. Prelim. Resp. Patent Owner does not dispute Petitioner's argument that the features indicated by the Office as providing allowability were the "staircase structure, a word line contact, and a local contact disposed on each channel structure and slit structure." Pet. 11. Nor does Patent Owner dispute Petitioner's assertions that Toyama teaches these limitations that, during prosecution, the Office found the applied prior art not to teach. Prelim. Resp. Because the record indicates that Toyama teaches limitations that the Office indicated as not being taught by the prior art and thereby conferring allowability, Petitioner sufficiently points out how the Examiner erred in its evaluation of the asserted prior art. Accordingly, factor (e) weighs against exercising our discretion to deny institution.

Regarding factor (f), it is uncontested that a communication from the Chinese Patent Office detailed the manner in which Toyama would render unpatentable at least one claim at issue during prosecution, and that this

discussion was not presented during prosecution. Such discussion involved Chinese patent law, and we agree with Patent Owner that the Chinese Patent Office communication does not show error by the Office. However, a discussion of how a submitted reference may be relevant to the patentability of a claim during prosecution weighs on our determination under § 325(d). *Cultec, Inc. v. Stormtech LLC*, Case IPR2017-00777, Paper 7 at 10–11 (August 22, 2017)(informative)(denying institution under § 325(d) where a submitted reference was accompanied by a "*detailed identification* of the relevant portions of" the reference). Here, no such identification of the relevant portions of Toyama was provided. Thus, some evidence exists under factor (f) that Toyama warrants reconsideration. Accordingly, factor (f) weighs slightly against exercising our discretion to deny institution.

In summary, we determine that although Toyama was presented to, and considered by, the Office during prosecution, Petitioner has sufficiently shown on the current record that the Office erred in its evaluation such that the prior consideration does not justify exercising our discretion to deny institution on that basis.

B. Mushiga and Makala

Patent Owner argues, "Mushiga does nothing to cure the deficiencies of Toyama with respect to a substrate with an isolation structure, a dielectric structure on the isolation structure, and TACs that extend vertically through both structures." Prelim. Resp. 23 (emphasis omitted). Patent Owner argues that the components in Mushiga that Petitioner erroneously maps to those claimed features have counterparts in Toyama. *Id.* at 25. Patent Owner argues that [t]he only features Petitioner relies on in Mushiga that Toyama lacks are "insulating material liners 302," "backside insulating layer 306," and "first through-substrate via structures 316." *Id.* at 29–30. Patent Owner

discounts those features as not being relevant to the challenged claims, and thus, those features do not differentiate Mushiga from Toyama. *Id.* at 30.

Patent Owner makes similar arguments against Makala. *Id.* at 30–31 (arguing that Makala is relied on only for its disclosure of "'source connections via structures 91,' which it maps to the claimed 'local contacts disposed on [. . .] the slit structures,'" and that Toyama teaches the same feature). Patent Owner argues that for those reasons, the Board should find that Mushiga and Makala are each substantially the same as Toyama. *Id.* at 30.

Patent Owner's arguments for Mushiga and Makala are premised on their teachings being cumulative to Toyama. However, because we determined that the Office erred in its consideration of Toyama, any similarity of its teachings to those of Mushiga and Makala also represent insufficient consideration of those teachings during prosecution. Accordingly, we do not exercise our discretion to deny institution based upon Mushiga and Makala.

IV. CONCLUSION

For the reasons discussed above, we conclude Petitioner has shown a reasonable likelihood of prevailing with respect to at least one of claims 15–17, 19, and 20. We determine that the record supports institution. Accordingly, we institute an *inter partes* review of all challenged claims under all grounds set forth in the Petition. 37 C.F.R. § 42.108(a) ("When instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim."); *see SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018) (noting that the language of 35 U.S.C. § 314(b) "indicates a binary choice—either institute review or don't"); *PGS Geophysical AS v. Iancu*,

891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute as requiring "a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition").

Our determination at this stage of the proceeding is based on the evidentiary record currently before us. This decision to institute trial is not a final decision as to patentability of any claim for which an *inter partes* review has been instituted. Our final decision will be based on the full record developed during trial.

V. ORDER

For the foregoing reasons, it is:

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review is hereby instituted for all asserted grounds on all asserted claims, i.e.:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
15–17, 19, 20	103	Toyama
15–17, 19, 20	103	Mushiga
15–17, 19, 20	103	Mushiga, Makala

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial will commence on the entry date of this Decision.

FOR PETITIONER:

Jeremy Lang
K. Herman
Travis Jensen
Parth Sagdeo
ORRICK, HERRINGTON & SUTCLIFFE LLP
ptabdocketjjl2@orrick.com
p52ptabdocket@orrick.com
t61ptabdocket@orrick.com
ptabdocketp2s7@orrick.com

For PATENT OWNER:

James Davis
Andrew Radsch
Christopher Bonny
Allen Cross
ROPES & GRAY LLP
james.l.davis@ropesgray.com
andrew.radsch@ropesgray.com
christopher.bonny@ropesgray.com
allen.cross@ropesgray.com