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Paper 30
Date: May 7, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

KOA CORPORATION,
Petitioner,

v.

VISHAY DALE ELECTRONICS, LLC,
Patent Owner.

IPR2019-00201
Patent 7,190,252 B2

Before KRISTEN L. DROESCH, CHRISTOPHER M. KAISER, and AMBER L. HAGY, *Administrative Patent Judges*.

DROESCH, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
Granting in-part Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

I. INTRODUCTION

We have authority to hear this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner establishes by the preponderance of the evidence that claims 12–14 of U.S. Patent No. 7,190,252 B2 (Ex. 1002, "'252 Patent") are unpatentable. Based on the entirety of record before us, we also determine that Petitioner does not establish by the preponderance of the evidence that proposed substitute claim 23 presented in the Motion to Amend is unpatentable.

A. Procedural History

KOA Corporation ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–21 of the '252 Patent. Paper 1 ("Pet"). Vishay Dale Electronics, LLC ("Patent Owner") timely filed a Preliminary Response. Paper 6 ("Prelim. Resp."). Pursuant to 35 U.S.C. § 314, we instituted trial on May 9, 2019, as to all of the challenged claims of the '252 Patent (Paper 9, "Institution Decision" or "Dec.").

After institution of trial, Patent Owner filed a Response (Paper 16, "PO Resp."), to which Petitioner filed a Reply (Paper 19, "Pet. Reply"), to which Patent Owner filed a Sur-reply (Paper 22, "Sur-reply").

Patent Owner also filed a Motion to Amend (Paper 17, "Mot. Amend"), to which Petitioner filed an Opposition (Paper 20). Pursuant to Patent Owner's request (*see* Mot. Amend 2–3), we issued Preliminary Guidance (Paper 21) on Patent Owner's Motion to Amend. Patent Owner filed a Reply (Paper 23) to Petitioner's Opposition, to which Petitioner filed a Sur-reply (Paper 27).

Petitioner relies on a first Declaration of Dr. Michael S. Randall (Ex. 1001) to support its Petition. Patent Owner relies on a Declaration of Dr. David W. Hughes (Ex. 2004) and a Declaration of Frank McGee (Ex. 2006) to support its Response. Petitioner relies on a second Declaration of Dr. Michael S. Randall (Ex. 1044) and a Declaration of Fumika Ogawa (Ex. 1016) in support of its Reply.

Patent Owner relies on a second Declaration of Dr. David W. Hughes (Ex. 2027) to support its Motion to Amend. Petitioner relies on a third Declaration of Dr. Michael S. Randall (Ex. 1045) to support its Opposition to the Motion to Amend.

Dr. Randall and Dr. Hughes were cross-examined during trial, and transcripts of Dr. Randall's deposition (Ex. 2010) and Dr. Hughes's deposition (Ex. 1046) are included in the record.

Oral argument was held on February 7, 2020. A transcript of the oral argument is included in the record. Paper 28 ("Tr.").

B. Related Proceedings

The parties represent that the '252 Patent is not involved in any pending litigation. Pet. 1; Paper 4, 1.

C. The '252 Patent (Ex. 1002)

The '252 Patent relates to a surface mount electrical resistor with a thermally conductive, electrically non-conductive filler. *See* Ex. 1002, 1:8–10.

Figures 3 and 4 of the ’252 Patent are reproduced below.

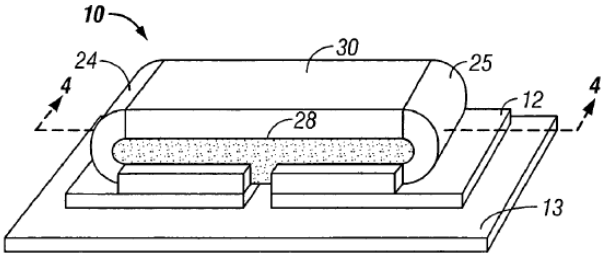


FIG. 3

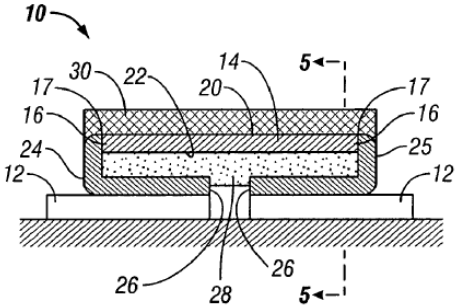
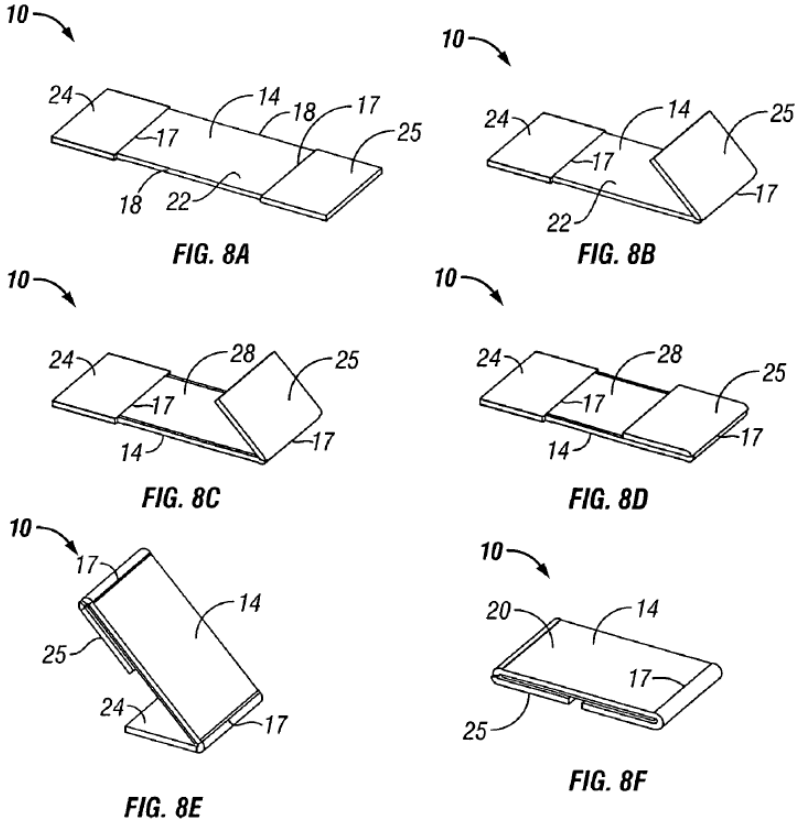


FIG. 4

Figure 3 is a perspective view of resistor 10 mounted on pads 12 on printed circuit board 13, and Figure 4 is a sectional view of resistor 10 taken along line 4–4 of Figure 3. *See* Ex. 1002, 3:42–45, 3:64–4:1. Resistor 10 includes resistive element 14[1] having top surface 20 and bottom surface 22 and terminations 24, 25[2] extending from opposite ends 16 of resistive element 14. *See id.* at 4:1–5. Terminations 24, 25 are welded to ends 16 of resistive element 14 at weld lines 17. *See id.* at 4:5–7. In another embodiment, the terminations are integral with the resistive element. *See id.* at 7:22–28, Fig. 10. Resistor 10 includes protective coating 30 on top surface 20 of resistive element 14 and thermally conductive and electrically non-conductive filler 28 filling the space between bottom surface 22 of resistive element 14 and terminations 24, 25. *See id.* at 4:14–17, 5:1–13. Filler 28 electrically isolates terminations 24, 25 from resistive element 14 except at the connection of terminations 24, 25 to opposite ends 16 of resistive element 14. *See id.* at 4:57–60.

[1] The ’252 Patent uses interchangeably the terms “resistive element” and “resistance element.”
[2] The ’252 Patent uses interchangeably the terms “termination[s]” and “terminal[s].”

Figures 8A through 8F of the ’252 Patent are reproduced below.



Figures 8A through 8F are perspective views showing steps in the manufacture of resistor 10. *See* Ex. 1002, 3:50–52, 5:26–27. Resistor 10 comprising resistive element 14 and terminations 24, 25, as shown in Figure 8A, is dipped in liquid primer material. *See id.* at 5:28–48. Termination 25 is bent to a 45° angle, as shown in Figure 8B. *See id.* at 5:41–43. Filler material 28 is applied to resistive element 14, as shown in Figure 8C. *See id.* at 5:49–6:9. Filler material 28 is adapted to be applied in an uncured state for curing at a later time. *See id*. at 5:64–65. Termination 25 is bent downwardly into contact with the uncured filler material 28, as shown in Figure 8D. *See id.* at 6:10–14. “Because the material 28 is not in a cured state as yet, the bending of the terminal 25 into contact therewith causes a depression in the filler material 28 thereby

causing the material 28 to ooze around the side edges and end of terminal 25." *Id.* at 6:14–18. Termination 24 is bent to a 45° angle, as shown in Figure 8E, and then bent into contact with the uncured filler material 28 in the same manner as termination 25, as shown in Figure 8F. *See id*. at 6:19–23. After the resistor is formed into the shape shown in Figure 8F, "the filler material 28 is permitted to cure and harden. When it cures and hardens it forms a bond between both the resistance element 14 and the terminals 24, 25." *Id.* at 6:23–27.

The '252 Patent discloses "[t]he resistors of the present invention have much lower operating temperatures than the prior art resistors." Ex. 1002, 6:37–38; *see id.* at 7:2–7, Fig. 9. Lower operating temperature correlates to better electrical performance and reliability. *See id.* at 6:43–45. Heat generated by resistive element 14 is dissipated through thermally conductive terminations 24, 25 and thermally conductive filler 28. *See id.* at 6:45–47. The reasons for improved heat dissipation are at least partially due to the bonding of filler 28 to resistive element 14 and terminations 24, 25 and the thinness of filler 28 between 0.0254 mm and 0.254 mm. *See id*. at 6:52–56. "Other reasons for improved heat dissipation include the fact that the terminations are bent into contact with the filler before the filler 28 is cured and is still pliable." *Id.* at 6:57–59. As a result, "the filler 28 is depressed during the manufacturing process to a minimal thickness before curing," "the manufacturing process allows the pliable filler 28 to conform to the [resistive] element 14 and terminations 24, 25 so as to prevent air bubbles which inhibit thermal conductivity," and "curing the filler 28 after forming[,] bonds the resistive element 14 and terminations 24, 25 to filler 28 to create intimate contact for maximum heat transfer." *Id.* at 6:59–67.

D. Illustrative Claims

Claims 1, 12, 15, and 19 are independent. Claims 2–11 depend ultimately from claim 1, claims 13 and 14 depend from claim 12, claims 16–18 depend ultimately from claim 15, and claims 20 and 21 depend from claim 19. Claims 1, 12, and 15 are illustrative and reproduced below:

> 1. An electrical resistor comprising:
> a resistive element having opposite ends, an upper surface and a lower surface;
> a first termination having a first end and a second end, the second end having an upwardly presented termination surface spaced a first space below the lower surface of the resistive element;
> a second termination having a first end and a second end the second end having an upwardly presented termination surface spaced a second space below the lower surface of the resistive element;
> the first and second terminations being electrically disconnected from one another except through the resistive element;
> a thermally conductive and electrically non-conductive filler filling the first and second spaces;
> the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler;
> the filler engaging, and being bonded to the lower surface of the resistive element and bonded at the depression of the filler to the upwardly presented termination surfaces of the first and second terminations; and
> the filler being an electrical non conductor and a heat conductor so that the filler is in heat conducting relation to both the resistive element and the first and second terminations whereby heat will be conducted from the resistive element through the filler to the first and second terminations.
>
> 12. An electrical resistor comprising:
> a resistive element having opposite ends, an upper surface and a lower surface;
> a first termination extending from one of the opposite ends of the resistive element;

a second termination extending from the other of the opposite ends of the resistive element;

the first and second terminations each having a second end extending under the lower surface of the resistive element and having a termination surface spaced a predetermined first space away from the resistance element, the first and second terminations being electrically disconnected from one another except through the resistive element;

a thermally conductive and electrically non-conductive filler, the filler engaging the lower surface of the resistive element and the termination surfaces of the first and second terminations, and being in heat conducting relation to both the resistive element and the first and second terminations whereby heat will be conducted from the resistive element through the filler to the first and second terminations; and

the first space having a thickness between the resistive element and the first and second terminations of between 0.0254 mm and 0.254 mm (1 mil and 10 mils).

15. A method for making an electrical resistor having a resistance element including first and second opposite ends, an upper surface, and a lower surface; a first termination extending from the first end of the resistance element; and a second termination extending from the second end of the resistance element; the method comprising:

placing a thermally conductive and electrically non-conductive filler in an uncured and unhardened state on the lower surface of the resistance element;

bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element;

forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state; and

permitting the filler material to cure and harden while in contact with the lower surface of the resistance element and the first and second terminations whereby the filler will conduct heat from the resistance element to the first and second terminations.

E. Asserted Grounds of Unpatentability and Asserted Prior Art

Petitioner challenges claims 1–21 as unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura (Ex. 1006[3]), and as unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art." *See* Pet. 3, 14–78.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

The Petition does not include an explicit discussion of the level of ordinary skill in the art. *See generally* Pet. For the purpose of the Institution Decision, we adopted Petitioner's declarant Dr. Randall's testimony regarding the level of ordinary skill in the art. *See* Dec. 11. Dr. Randall testifies that a person of ordinary skill in the art, "at the time of filing of the '252 patent, would hold a Masters' Degree in Materials Science or Engineering or an analogous degree, and at least two years of relevant/applied industry experience." Ex. 1001 ¶ 20. Dr. Randall further testifies that "the level of ordinary skill in the art is evidenced by the prior art references." *Id.*

Patent Owner contends the prior art discussed in the Patent Owner Response, and in the declaration of Dr. Hughes, demonstrates that a person of ordinary skill in the art "would have been a person possessing a Bachelor of Engineering degree, a Bachelor of Science degree in Engineering, or a Bachelor of Science degree in Physics, and, in addition, have approximately two or more years of related experience." *See* PO Resp. 14 (citing Ex. 2004 ¶ 7).

[3] JP 2004-012800 A, published April 22, 2004.

The parties dispute which of the two proposed definitions of a person of the ordinary skill in the art should be adopted by the Board. *See* PO Resp. 14; Pet. Reply 1–2; Sur–reply 1–2. Notwithstanding the dispute between the parties regarding a precise definition of a person of ordinary skill in the art, as demonstrated in the analysis below, an explicit definition of a person of ordinary skill in the art is not necessary to resolve the issues before us. For the purpose of resolving the disputes before us, either proposed definition and the references themselves provide evidence of the level of ordinary skill in the art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

B. Claim Construction

For petitions filed before November 13, 2018, claims of an unexpired patent that will not expire before issuance of a final written decision are interpreted using the broadest reasonable interpretation in light of the specification. *See* 37 C.F.R. § 42.100(b) (2018)[4]; *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). "[T]he specification 'is always highly relevant to the

[4] The amendment to Rule 42.100(b) does not apply here because the Petition was filed before November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018).

claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (en banc) (quoting *Vitrionics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (1996)). Extrinsic evidence, such as dictionaries and expert testimony, may be useful, but it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence. *Phillips*, 415 F.3d at 1319.

Petitioner and Patent Owner offer different claim constructions for "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler" and "bonded" recited in independent claims 1, 14, and 19. *See* Pet. 12–13; PO Resp. 15–27; Pet. Reply 2–7.

1. "The Upwardly Presented Termination Surfaces of the First and Second Terminations Forming a Depression in the Filler"

a. Patent Owner's Explicit Proposed Construction

Patent Owner asserts that "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler" should be construed as "the upwardly presented termination surfaces of the first and second terminations pressing into the filler material so as to create a deformation in the filler material." *See* PO Resp. 15, 20 (citing Ex. 2004 ¶ 39). Patent Owner contends the claim language is consistent with its proposed construction because it requires the termination surfaces form a depression. *See id.* at 15. According to Patent Owner, "[a] depression is not 'formed' when a termination is merely brought into contact with a cured and hardened filler." *Id.* Patent Owner asserts the '252 Patent Specification is consistent with its proposed construction because it discloses

the nature of the depression and how and where it is formed. *See id.* at 15–16 (citing Ex. 2004 ¶ 33). Patent Owner asserts that the '252 Patent teaches: (1) the terminals form the depression by depressing or squeezing the uncured filler, and (2) bending the terminal into contact with the uncured filler material causes a depression in the filler material. *See id.* at 16 (quoting Ex. 1002, 4:21–25, 6:14–18, 6:27–31).

In reply, Petitioner contends that Patent Owner's proposed construction is improper because claim 1 is directed to a product and the plain language of the claim does not specify the process by which the depression is formed. *See* Pet. Reply 2–3. Petitioner proposes no construction for this phrase and asserts that "its plain and ordinary meaning applies." *Id.* at 4.

In response, Patent Owner asserts that because claim 1 requires the act of "forming," it is a product-by-process claim. *See* Sur-reply 2 (citing *Greenliant Sys., Inc. v. Xicor LLC*, 692 F.3d 1261, 1264–65 (Fed. Cir. 2012)). Patent Owner provides quotations from several cases emphasizing that the process by which a product is made may impart structural and functional differences to the claimed product that may distinguish it from the prior art. *See id.* at 2–3 (quoting *Greenliant*, 692 F.3d at 1268; *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1319 (Fed. Cir. 2006); *In re Garnero*, 412 F.2d 276, 279 (CCPA 1969)). Patent Owner asserts that pressing the terminals into the filler to cause a depression is an essential aspect of the claimed invention. *See* PO Resp. 16. According to Patent Owner, "the squeezing action by the terminals of the uncured filler compresses the filler to eliminate air bubbles that may prevent optimum heat transfer." *Id.* (citing Ex. 1002, 6:61–64). Patent Owner asserts the '252

Patent Specification differentiates the claimed invention from prior art resistors in which the leads are merely bent around and into contact with the filler material. *See id.* at 17–18 (reproducing Ex. 1002, Fig. 2; quoting Ex. 1002, 1:54–58, 2:8–19).

In reply, Petitioner contends that in order for a process limitation to be read into a product claim, the process limitation must be an essential part of the claimed invention. *See* Pet. Reply 3 (citing *Continental Circuits LLC v. Intel Corp.*, 915 F.3d 788, 799 (Fed. Cir. 2019)). Petitioner contends that the '252 Patent Specification contains no indication that "pressing" is an essential element of the claimed resistor. *See id.* Petitioner argues the '252 Patent Specification requires only that the filler be capable of being depressed or squeezed to form the depression. *See id.* (quoting Ex. 1002, 4:22–24; citing Ex. 1002 6:14–17, 6:27–31). According to Petitioner, pressing is only one means of forming the depression. *See id.* Petitioner argues the '252 Patent does not clearly and unmistakably disavow other means of forming the depression. *See id.*

Patent Owner contests Petitioner's assertion that "pressing" is not essential to making the claimed product. *See* Sur-reply 3 (citing Pet. Reply 3). According to Patent Owner, the claim language, '252 Patent Specification, and '252 Patent file history demonstrate that "pressing" is essential to making the claimed product. *See id.* at 4. Patent Owner contends that the claim language "forming a depression in the filler" requires a pressing action that creates a depression. *See id.* Patent Owner argues that forming of the depression results in the inventive product. *See id.* Specifically, Patent Owner contends that the claimed resistor is an improvement over the prior art because the prior art has a significantly

higher temperature rise than devices formed by the claimed process. *See id.* (citing Ex. 1002, 6:10–7:21; Fig. 9). Patent Owner further argues that pressing the contacts into the uncured filler causes a depression in the filler material that ensures the filler is pressed to a minimal thickness, air bubbles are squeezed out of the filler, and a bond is created between the resistive element, filler, and terminations. *See id.* (citing Ex. 1002, 6:57–67). Patent Owner further asserts that Petitioner offers no facts to show that another way of forming the depression would impart the distinctive structural characteristics of the claimed resistor, and the '252 Patent does not describe another way to form the distinctive structural characteristics. *See id.* at 5–6.

Patent Owner also contends the prosecution history supports its proposed construction. *See* PO Resp. 18. According to Patent Owner, to differentiate the claimed invention from the prior art, during prosecution Applicants disclaimed any interpretation of this phrase in which the terminal surfaces are not pressed into the filler to cause a depression. *See id.* at 18–19 (reproducing Ex. 2005, Fig. 5; quoting Ex. 1003, Dec. 20, 2006 Amendment 7, 8; Ex. 2005, 5:47–6:24; citing Ex. 2004 ¶¶ 34, 35); Sur-reply 5 (quoting Ex. 1003, Dec. 20, 2006 Amendment 8; citing PO Resp. 12; Ex. 1003, Dec. 20, 2006 Amendment, 7–8; Ex. 2004 ¶ 35). More specifically, Patent Owner argues that "the Applicants disclaimed any construction for this claim element that encompasses the structure in Figure 5 of Pryst, in which the upwardly presented termination surface is merely bent to be 'close to the body' of the filler to fill a preexisting space." *See* PO Resp. 19. Patent Owner argues the broadest reasonable interpretation of the claim phrase cannot be so broad as to encompass the resistor described in Pryst where the lead is merely bent to press up against the cured filler, but

does not cause a depression in the filler. *See id.* (citing Ex. 2005, 4:51–57). Patent Owner contends that, according to the file history, the terminations must not just reside in a depressed region, but must actually form the depression. *See* Sur-reply 5.

In reply, Petitioner contends that the '252 Patent prosecution history does not support Patent Owner's alleged disclaimer because Applicant argued, with respect to the product claims, that the cited prior art did not teach a depression in the filler. *See* Pet. Reply 3. (citing PO Resp. 12–13, 16). Petitioner contends that it was the Examiner, not Applicant, who mentioned squeezing the terminations and forcing them into contact with the filler in the context of the method claims. *See id.* at 3–4 (citing PO Resp. 13). Petitioner asserts that Applicant did not argue that the pressing limitation is essential. *See id.* at 4.

Patent Owner also contends that its proposed construction is consistent with the testimony of Petitioner's declarant, Dr. Randall, that in the context of the '252 Patent, a person of ordinary skill in the art would understand forming a depression in the filler to mean pressing the termination into the filler so as to create a deformation in the filler, or forming a cavity or deformation in the filler. *See* PO Resp. 19–20 (quoting Ex. 1001 ¶ 35). Patent Owner contends the definition is consistent with dictionary definitions that define "depressed" as something that is pressed down. *See id.* at 20 (citing Ex. 2004 ¶ 36; Ex. 2009, 370–71).

In reply, Petitioner contends that Patent Owner misrepresents Dr. Randall's testimony to support its proposed construction. *See* Pet. Reply 4 (citing PO Resp. 20). Petitioner asserts that Dr. Randall's testimony

is consistent with the intrinsic evidence and does not support importing a limitation into the claim. *See id.* (citing Ex. 1001 ¶¶ 24–25).

We agree with Patent Owner that claim 1 is a product-by-process claim because claim 1 requires the act of "forming." Stated another way, and in accordance with English language subject-verb-object relationships, "the filler" is the object acted upon during the "forming a depression" step by the subject "the upwardly presented termination surfaces of the first and second terminations."

We decline, however, Patent Owner's invitation to read limitations into the claim from the Specification—specifically, we decline to read ". . . forming a depression in the filler" as "pressing into the filler material so as to create a deformation in the filler material," as Patent Owner proposes. *See* PO Resp. 15, 20. Although claims are interpreted in light of the specification, it is improper to read limitations into the claims from particular embodiments or examples given in the specification. *See Constant v. Advanced Micro-Devices, Inc*., 848 F.2d 1560, 1571 (Fed. Cir. 1988). We understand that the '252 Patent Specification discloses pressing terminals into uncured filler material to cause a depression as the process for forming a depression in the filler. However, the mere fact that the Specification discloses only an embodiment in which a depression is formed does not require importing into the claims the unrecited limitation of pressing into the filler material so as to create a deformation in the filler material. The Federal Circuit "ha[s] expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." *Phillips*, 415 F.3d at 1312–13.

We also agree with Petitioner that the ’252 Patent Specification does not disavow other processes for forming a depression in the filler, nor does the ’252 Patent Prosecution history disclaim other processes for forming a depression in the filler. Patent Owner’s arguments and supporting evidence to the contrary merely support a distinction between “forming a depression in the filler” compared to prior art methods in which a depression is not formed in the filler. For example, the ’252 Patent discloses a prior art resistor in which there is no filler material (*see* Ex. 1001, 1:37–43, Fig. 1), and a prior art resistor that includes terminations that are folded under the resistive element and bent into contact with the filler, but not attached or bonded to the filler, resulting in the filler residing between the resistive element and the terminations (*see* Ex. 1001, 1:44–61, 7:9–21; Fig. 2). Likewise, the cited ’252 Patent prosecution history reveals that Applicant distinguished application claim 21 (which issued as claim 1) from the Pryst reference (Ex. 2005)[5] by arguing that “there is no showing of the upwardly presented terminations forming a depression in the filler.” *See* Ex. 1003, Dec. 20, 2006 Amendment 7–8.

We also recognize that Petitioner’s declarant Dr. Randall testified that “in the context of the ‘252 patent, a [person of ordinary skill in the art] (POSITA) would understand the term ‘forming a depression in the filler’ to mean ‘pressing the termination into the filler so as to create a deformation in the filler,’ or ‘forming a cavity or deformation in the filler’.” Ex. 1001 ¶ 35. “[E]xtrinsic evidence ‘can shed useful light on the relevant art,’” but “it is ‘less significant than the intrinsic record in determining the legally operative

[5] U.S. Reissued Patent No. 33,541, Feb. 19, 1991.

meaning of claim language.'" *Phillips*, 415 F.3d at 1317. "[T]estimony 'that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent'" should be discounted. *Id.* at 1318 (quoting *Key Pharms. v. Hercon Labs. Corp.*, 161 F.3d 709, 716 (Fed Cir. 1998)). Accordingly, based on the arguments and evidence presented, we do not find that Dr. Randall's testimony supersedes the intrinsic evidence.

In sum, based on the arguments and evidence presented, we agree with Patent Owner that claim 1 is a product-by-process claim in which the upwardly presented surfaces of the first and second terminations "form[] a depression in the filler." We conclude, however, that Patent Owner's proposed claim construction improperly seeks to import a limitation into the claim—specifically, a limitation of "pressing into the filler material so as to create a deformation in the filler material." As such, Patent Owner's proposed construction is not consistent with the broadest reasonable interpretation in light of the specification for "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler." Nonetheless, our analysis does not end here, because the parties present additional arguments addressing whether structure and function is imparted by "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler."

b. Structure and Function Imparted by a Product-By-Process Claim

As discussed above, we agree with Patent Owner that recitation of "the upwardly presented termination surfaces of the first and second

terminations forming a depression in the filler" renders claim 1 a product-by-process claim. We agree with Petitioner (*see* Pet. Reply 12) that the correct standard for patentability of a product-by-process claim is set forth in *Thorpe* as follows:

> Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself.
>
> The patentability of a product does not depend on its method of production. If the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior art product was made by a different process.

In re Thorpe, 777 F.2d 695, 697 (Fed. Cir. 1985). However, "if the process by which a product is made imparts 'structural and functional differences' distinguishing the claimed product from the prior art, then those differences 'are relevant as evidence of no anticipation' although they 'are not explicitly part of the claim.'" *Greenliant*, 692 F.3d at 1268 (quoting *Amgen Inc. v. Hoffman–La Roche Ltd.*, 580 F.3d 1340, 1370 (Fed. Cir. 2009) (*Greenliant* quoted with approval in *Purdue Pharma L.P. v. Epic Pharma LLC*, 811 F.3d 1345, 1354 (Fed. Cir. 2016); *accord In re Nordt Development Co., LLC*, 881 F.3d 1371, 1374–75 (Fed. Cir. 2018) ("If the process limitation connotes specific structure and may be considered a structural limitation . . . that structure should be considered." (citing *Garnero*, 412 F.2d at 279)).

Thus, in considering patentability of product-by-process claims, such as claim 1 of the '252 Patent, we consider whether the process steps impart structural and functional differences to the claimed product, such that they are afforded patentable weight.

Patent Owner asserts that the process of squeezing the terminations toward the uncured filler to form the depression "defines the claimed invention in terms of the process by which it is made." PO Resp. 51 (citing *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 159 n.*(1989)). According to Patent Owner, the process steps impart structural differences to the claimed product because "forming the depressions through the squeezing of the terminations into the uncured filler material, the resultant product is inured with small dimensions and high thermal conductivity." *Id.* (citing Ex. 1002, 6:52–7:2). Patent Owner asserts that, during the step of forming the depression in the filler, the squeezing action by the terminals of the uncured filler compresses the filler to eliminate air bubbles that may prevent optimum heat transfer. *See id.* at 16 (citing Ex. 1002, 6:61–64); *see also id.* at 26 (citing Ex. 1002, 6:57–64, similar argument addressing "bond"); 36 (citing Ex. 1002, 6:14–18, 6:61–64, similar argument addressing claim 15).

As noted above, Petitioner disputes that the alleged product-by-process limitation in claim 1 should be afforded patentable weight. *See* Pet. Reply 12 (citing *In re Thorpe*, 777 F.2d at 698). Petitioner contends that Patent Owner has not shown how the process of forming the depression alters the structure of the depression, or how the depression structurally differs from a depression formed by a different means, such as machining through a cutting tool. *See id.* at 12–13.

In response, Patent Owner contends that pressing the termination surfaces into the filler to form a depression, as recited in claim 1, results in a resistor with a fundamentally different structure than the structure of a resistor formed by a different process, such as Nakamura's embodiment

depicted in Fig. 5. *See* Sur-reply 14 (citing Ex. 1006). According to Patent Owner, the claimed depression is formed by the terminations being pressed into the uncured filler, so the filler can be compressed to a minimal thickness, and at the same time, the formation of the depression squeezes out any air bubbles to maximize heat transfer. *See id.* (citing Ex. 1002, 6:52–67). According to Patent Owner, the '252 Patent describes that "this results in distinctive structural characteristics such as a minimal thickness, fewer air bubbles, and thus a lower operating temperature than the prior art." *Id.* (citing Ex. 1002, 6:10–7:21, Fig. 9; Sur-reply 2–6).

We are not persuaded by Petitioner's argument that Patent Owner has not come forward with evidence showing that the process of forming the depression alters the structure, or how the structure differs from those formed by a different means. *See* Pet. Reply 12–13. Contrary to Petitioner's argument, Patent Owner has come forward with evidence to support its assertion that "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler" imparts the following structural and functional differences: minimal filler thickness and elimination or air bubbles in the filler, thereby maximizing thermal conductivity of the filler and lowering the resistor operating temperature. *See* PO Resp. 16 (citing Ex. 1002, 6:61–64), 26 (citing Ex. 1002, 6:57–64), 36 (citing Ex. 1002, 6:14–18, 6:61–64), 51 (citing Ex. 1002, 6:52–7:2); Sur-reply 4–5 (citing Ex. 1002, 6:10–7:21, Fig. 9), 14 (citing Ex. 1002, 6:10–7:21, Fig. 9). The '252 Patent discloses lower operating temperature and improved heat dissipation of the claimed resistor "are at least partially due to the bonding of filler 28 to both the resistance element 14 and the terminations 24, 25 and also partially due to the thinness of the filler 28

between 0.0254 mm and 0.254 mm." Ex. 1002, 6:52–56 (emphasis added). The '252 Patent further discloses "[***o***]***ther reasons for improved heat dissipation include*** the fact that the terminations are bent into contact with the filler before the filler 28 is cured and is still pliable," such that: (1) the filler is depressed to a minimal thickness before curing; (2) the filler is allowed to conform to resistive element and terminations to prevent air bubbles, which inhibit thermal conductivity; and (3) subsequent curing of the filler bonds the resistive element and terminations to the filler to create intimate contact for maximum heat transfer. *Id.* at 6:57–7:2 (emphasis added).

Accordingly, we determine that the recitation in claim 1 of "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," although it is a recitation of a product-by-process, is afforded patentable weight because employing this step imparts distinguishing structure and function to the claimed product. In particular, a product produced by this process has different structure and function than a product in which the terminations are merely folded into contact with the filler because this process results in a product with a filler having reduced air bubbles and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature.

2. "Bonded"

Petitioner asserts "bonded" as recited in claims 1, 14, and 19 should be construed as "firmly adhered." *See* Pet. 13 (citing Ex. 1001 ¶¶ 40–44); Pet. Reply 7 (citing Ex. 1001 ¶¶ 37–43; Ex. 1044 ¶¶ 27–34). Patent Owner contends that the proper construction for "bonded" is "an interconnection that performs a permanent electrical and/or mechanical function." *See* PO

Resp. 21, 27. As demonstrated in the analysis below, we need not construe explicitly the term "bonded."

3. Other Claim Terms and Phrases

As demonstrated in the analysis below, no other claim terms or phrases require an explicit construction. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e 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))).

C. Principles of Law

"Under 35 U.S.C. § 102 a claim is anticipated 'if each and every limitation is found either expressly or inherently in a single prior art reference.'" *King Pharm., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1274 (Fed. Cir. 2010) (quoting *Celeritas Techs. Ltd. v. Rockwell Int'l Corp.*, 150 F.3d 1354, 1360 (Fed. Cir. 1998)). "Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim." *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed. Cir. 2010).

A reference inherently discloses an element of a claim "if that missing characteristic is necessarily present, or inherent, in the single anticipating reference." *Schering Corp. v. Geneva Pharms.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003) (citation omitted) (emphasis added). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient."

Therasense, 593 F.3d at 1332 (quoting *Cont'l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1269 (Fed. Cir. 1991)).

A claim is unpatentable under 35 U.S.C. § 103(a) 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 the 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 skill in the art; and (4) if in evidence, so-called secondary considerations.[6] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). Although the burden of production may shift, the burden of persuasion on the issue of patentability remains with Petitioner always and never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must support its challenge by a preponderance of the evidence. 35 U.S.C.

[6] The record before us does not include evidence of secondary considerations.[7] During the preliminary proceedings, Patent Owner pointed out that Petitioner's translation (Ex. 1006) did not comply with 37 C.F.R. § 42.63(b). *See* Prelim. Resp. 3, 14–15; Dec. Inst. 8–9. According to Petitioner, a certificate of translation (Ex. 1010) was served as supplemental evidence on Patent Owner's counsel. *See* Reply 14 n.2.

§ 316(e); 37 C.F.R. § 42.1(d). We analyze the challenges presented in the Petition in accordance with the above-stated principles.

D. Unpatentability of Claims 1–21

1. Overview of Nakamura (Exs. 1006, 1007, 2002)[7]

Nakamura discloses a metal plate resistor and methods of manufacturing the metal plate resistor. *See* Ex. 1006, codes (54), (57); Ex. 2002, codes (54), (57).

Figure 1 of Nakamura is reproduced below.

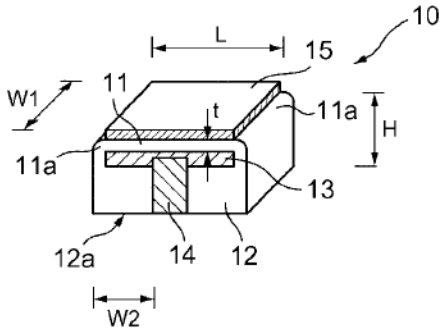


Figure 1 depicts metal plate resistor 10 including resistor section 11, pair of block-shaped electrode sections 12, insulation layer 13, insulator block 14, and heat-resistive protection layer 15. *See* Ex. 1006 ¶¶ 13–14; Ex. 2002 ¶¶ 13–14. Resistor section 11 is made of metal and formed in the shape of a thin metal plate. *See* Ex. 1006 ¶ 14; Ex. 2002 ¶ 14. Block-shaped electrode sections 12 are connected to both ends 11a of resistor section 11. *See* Ex. 1006 ¶ 14; Ex. 2002 ¶ 14. Resistor section 11 is supported by block-

[7] During the preliminary proceedings, Patent Owner pointed out that Petitioner's translation (Ex. 1006) did not comply with 37 C.F.R. § 42.63(b). *See* Prelim. Resp. 3, 14–15; Dec. Inst. 8–9. According to Petitioner, a certificate of translation (Ex. 1010) was served as supplemental evidence on Patent Owner's counsel. *See* Reply 14 n.2.

shaped electrode sections 12 via insulating layer 13. *See* Ex. 1006 ¶ 14; Ex. 2002 ¶ 14.

Figure 2 of Nakamura is reproduced below.

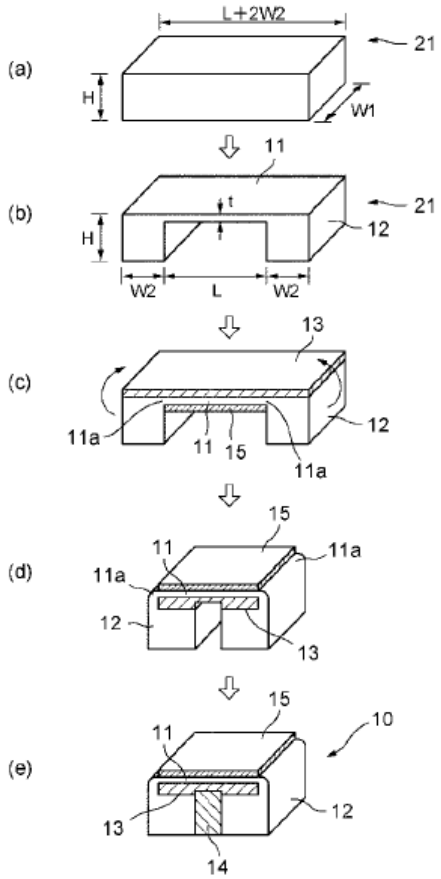


Figure 2 depicts a method of making metal plate resistor 10. *See* Ex. 1006 ¶ 23; Ex. 2002 ¶ 23. First, resistive metal material 21 having width W1, length L + 2W2, and height H is prepared. *See* Ex. 1006 ¶ 23; Ex. 1007, Fig. 2(a); Ex. 2002 ¶ 23. Resistor section 11 and electrode section 12 are made by applying a cutting or etching process to resistance metal material 21, so that a desired plate thickness t is maintained along a portion of length L of a central part of one side of resistive metal material 21. *See* Ex. 1006 ¶ 24; Ex. 1007, Fig. 2(b); Ex. 2002 ¶ 24. According to Petitioner's translation, "an insulating resin such as a polyimide or epoxy is

coated on one face side . . . of the resistance metal material 21 so as to form insulation layer 13 having a thickness of 50 μm to 150 μm." Ex. 1006 ¶ 25; *see* Ex. 1007, Fig. 2(c). According to Patent Owner's translation, "an insulating resin such as a polyimide or epoxy is applied to the required thickness, for example, from 50 μm to 150 μm, on one side of the resistive metal material 21 . . . to form an insulating layer 13." Ex. 2002 ¶ 25; *see* Ex. 1007, Fig. 2(c). As a result of folding electrode sections 12 by 180° in directions toward each other with both ends 11a of resistor section 11 serving as axes, a laminated structure is obtained in which insulating layer 13 is interposed between resistor section 11 and electrode sections 12. *See* Ex. 1006 ¶ 25; Ex. 1007, Fig. 2(d); Ex. 2002 ¶ 25. According to Petitioner's translation, "the insulation layers 13 on the upper faces of the electrode sections 12 *closely adhere* to the insulation layer 13 of the upper face of the resistor section 11 as shown in the figure." Ex. 1006 ¶ 25 (emphasis added). According to Patent Owner's translation, "[a]t this time, the insulating layer 13 on the upper surface of the electrode portions 12 comes into *close contact* with the insulating layer 13 on the upper surface of the resistor portion 11." Ex. 2002 ¶ 25 (emphasis added). In the last step, insulating block 14 is fitted and fixed between electrodes 12. *See* Ex. 1006 ¶ 26; Ex. 1007, Fig. 2(e); Ex. 2002 ¶ 26. According to Petitioner's translation, "the resistor section 11 is secured to the pair of electrode sections 12 through an insulation layer 13." Ex. 1006 code (57); *see id.* ¶¶ 8, 11, claims 1, 4. According to Patent Owner's translation, "the resistor portion 11 [is] fixed to the electrode portions 12 via an insulating layer 13." Ex. 2002 code (57); *see id.* ¶¶ 8, 11, claims 1, 4.

Figure 3 of Nakamura is reproduced below.

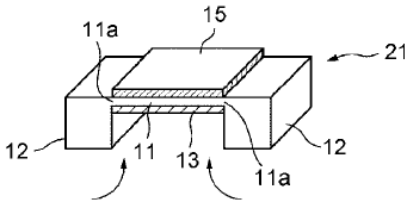


Figure 3 depicts an alternative method of making metal plate resistor 10. *See* Ex. 1006 ¶ 29; Ex. 2002 ¶ 29. Insulating layer 13 is formed on the lower side of resistor section 11. *See* Ex. 1006 ¶ 29; Ex. 2002 ¶ 29. According to Petitioner's translation, a laminated structure, in which the insulating layer 13 is sandwiched between resistor section 11 and electrode sections 12, is made by bending electrode sections 90° around the axes of both ends 11a of resistor section 11 in an inward direction "so as to closely adhere to the insulation layer 13." Ex. 1006 ¶ 29. According to Patent Owner's translation,

> by folding the electrode portions 12 by 90° in a direction inward toward each other with both ends 11a of the resistor portion 11 serving as axes so that the insulating layer 13 is brought into close contact, a laminated structure is obtained in which the insulating layer 13 is interposed between the resistor portion 11 and the electrode portions 12. At this time, the side surfaces of the electrode portions 12 in the figure are brought into close contact with the insulating layer 13.

Ex. 2002 ¶ 29.

Figure 5 of Nakamura is reproduced below.

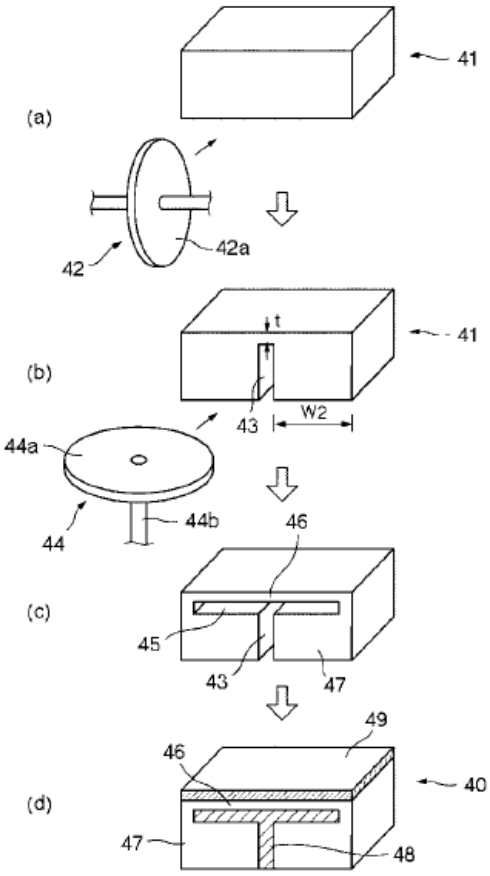


Figure 5 depicts another method of making metal plate resistor 40. *See* Ex. 1006 ¶ 31; Ex. 2002 ¶ 31. First, resistive metal material 41 is produced. *See* Ex. 1006 ¶ 31; Ex. 1007, Fig. 5(a); Ex. 2002 ¶ 31. The center of resistive metal material 41 is cut vertically on the lower side using rotary blade 42a of cutting tool 42 to form vertical groove 43. *See* Ex. 1006 ¶ 31; Ex. 1007, Fig. 5(b); Ex. 2002 ¶ 31. A horizontal cut is made using vertical groove 43 as a guide for rotating shaft 44b of cutting tool 44 in which rotary blade 44a rotates on the horizontal plane to form horizontal groove 45 with portions of resistive metal material 41 remaining on both sides to produce resistor section 46 and electrode sections 47. *See* Ex. 1006 ¶ 31; Ex. 1007, Fig. 5(c); Ex. 2002 ¶ 31. Vertical groove 43 and horizontal groove 45 are

filled with an insulating resin to form T-shaped insulating layer 48. *See* Ex. 1006 ¶ 31; Ex. 1007, Fig. 5(d); Ex. 2002 ¶ 31. Vertical groove 43 and horizontal groove 45 can be filled with an insulating resin either by injecting molten resin into the grooves or by fitting a solid resin into the grooves. *See* Ex. 1006 ¶ 31; Ex. 2002 ¶ 31.

2. Unpatentability of Claims 1–11 under 35 U.S.C. § 102(a)

a. Claim 1: "An electrical resistor: comprising a resistive element . . . ; a first termination; a second termination . . .; the first and second terminations being electrically disconnected from one another . . ."

Petitioner asserts that, as recited in claim 1, Nakamura discloses:

> [a]n electrical resistor comprising: a resistive element having opposite ends, an upper surface and a lower surface; a first termination having a first end and a second end, the second end having an upwardly presented termination surface spaced a first space below the lower surface of the resistive element; a second termination having a first end and a second end, the second end having an upwardly presented termination surface spaced a second space below the lower surface of the resistive element, the first and second terminations being electrically disconnected from one another except through the resistive element.

Petitioner's assertion is based on Nakamura's disclosure of a metal plate resistor including resistor section 11, 46, having opposite ends and upper and lower surfaces, and first and second electrode sections 12, 47, with upwardly presented termination surfaces spaced first and second spaces below the lower surface of resistor section 11, 46. *See* Pet. 14–18 (reproducing Ex. 1007, Figs. 1, 5c with annotations; quoting Ex. 1006 ¶ 1, "Solving Means," claim 1; citing Ex. 1007, Figs. 1–5; Ex. 1001 ¶ 102); Pet. 66–67. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See* PO Resp. 47–63.

Based on the entire trial record before us, we find that Nakamura teaches "[a]n electrical resistor: comprising a resistive element . . . ; a first termination; a second termination . . . ; the first and second terminations being electrically disconnected from one another . . . ," as recited in claim 1.

b. Claim 1: "a thermally conductive and electrically non-conductive filler"

Petitioner also contends Nakamura discloses "a thermally conductive and electrically non-conductive filler filling the first and second spaces," as recited in claim 1, based on Nakamura's disclosure of an insulating resin, such as polyimide and epoxy, to form the insulating layer, which fills the spaces between the resistive section and the two electrodes 12, 47, and in which heat radiates through insulating layer 13 to electrode sections 12. *See* Pet. 18 (quoting Ex. 1006 ¶ 25; citing Ex. 1006 ¶¶ 9, 27; Ex. 1007, Figs. 1, 4; Ex. 1002, 4:33–34, 4:48–51, 5:59–65; Ex. 1001 ¶ 103), Pet. 67; *see also* Ex. 1007, Fig. 5 (embodiment showing insulating layer 13 and electrodes 47). Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See* PO Resp. 47–63.

Based on the entire trial record before us, we find that Nakamura teaches "a thermally conductive and electrically non-conductive filler," as recited in claim 1.

c. Claim 1: "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler"

(1) Nakamura's Embodiment of Figure 5

Petitioner asserts that Nakamura discloses "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," recited in claim 1, based on the disclosure of Nakamura's embodiment of Figure 5. *See* Pet. 18–19 (reproducing

Ex. 1007, Fig. 5d with annotations; Ex. 1002, Fig. 4 with annotations; citing Ex. 1001 ¶ 104; Ex. 1006 ¶ 31). More specifically, Petitioner asserts that Nakamura's disclosure in Figure 5(d) "shows ends of the electrode sections 47 upwardly presenting termination surfaces of the first and second terminations, to form ***two depressions*** in the filler, specifically a T-like shaped filler insulation layer 48 extending at least partially within the termination space." *Id.* (reproducing Ex. 1007, Fig. 5d with annotations; reproducing Ex. 1002, Fig. 4 with annotations; citing Ex. 1006 ¶ 31; Ex. 1001 ¶ 104).

In response, Patent Owner argues that the embodiment of Figure 5 does not disclose the "terminations forming a depression in the filler" because Nakamura discloses that, for the embodiment of Figure 5, the terminations are formed by cutting a block of metal and inserting an insulator into the newly formed cavity. *See* PO Resp. 50–51 (citing Ex. 2010, 110:3–8, 111:7–10). According to Patent Owner, no depression is formed into the insulator by the first and second terminations. *See id.* at 51 (citing Ex. 2004 ¶ 42).

Petitioner takes the position that the "plain language of the claim does not specify the process by which the depression is formed." Pet. Reply 2–3. As discussed above in Section II.B.1.b., we disagree with Petitioner's position, and determine that "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler" is a product-by-process limitation that is afforded patentable weight because it imparts distinguishing structure and function, such as a filler having reduced air bubbles and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature. Petitioner's

arguments are, therefore, premised on a construction of the claim that we do not adopt.

For the foregoing reasons, Petitioner does not present evidence sufficient to demonstrate that Nakamura's embodiment of Figure 5 discloses "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," specifically, the structure and function imparted to the product by the process.

(2) Nakamura's Embodiments of Figures 1–4

Petitioner also presents arguments asserting that Nakamura's embodiments of Figures 1–4 disclose "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," as recited in claim 1. Petitioner contends that a person of ordinary skill in the art

> understands that in forming the laminated resistor structure of Figs. 1–4 of Nakamura, a depression is formed in the filler material. The filler between the lower surface of the resistive element and the upper surfaces of the termination is sandwiched and squeezed by the upper surfaces of the terminations during the lamination process. This results in close adherence of the filler to the upper surfaces of the terminations, as well as to the lower surface of the resistive element.

Pet. 19 (citing Ex. 1006 ¶¶ 25, 29; Ex. 1001 ¶ 105). Petitioner further asserts a person of ordinary skill in the art would understand that the process of forming a laminated structure would create a depression in the insulation layer because lamination involves bonding with heat and pressure of the layers of material within the laminated structure. *See id.* at 21 (citing Ex. 1001 ¶¶ 129, 132). Finally, Petitioner contends a person of ordinary skill in the art "would understand that the bending and lamination of

electrodes into close contact with the filler and the resistive element would create a depression in the filler in the regions above the upwardly presented surface of the first and second electrodes (terminations) respectively." *Id.* at 21–22 (citing Ex. 1001 ¶ 133).

In response, Patent Owner argues that in Nakamura there is no disclosure of a depression in the embodiments of Figures 1–4 and no disclosures of a depression based on Nakamura's process of making the resistors of Figs. 1–4. *See* PO Resp. 48 (citing Pet. 19; Ex. 1006 ¶¶ 25, 29; Ex. 2004 ¶¶ 48–51); *id.* at 50 (similar argument). Patent Owner contends that the lack of a depression is confirmed by Figures 1, 2(e), and 4, which reveal no depressions. *See id.* at 48–49 (reproducing Ex. 1007, Figs. 1, 2(e), 4); Sur-reply 9. Patent Owner further asserts that Nakamura does not disclose a depression because: (1) Nakamura's figures "show the insulation layer 13 is twice as thick between each electrode section 12 and the resistive layer 11 'as a result of the electrode section 12 being turned around the axes . . . by an angle of 180^0,'" and (2) the figures show the insulation thickness over the area above the electrodes is greater than the insulation thickness above the insulating block 14. *See* PO Resp. 48–49 (reproducing Ex. 1007, Figs. 1, 2e, 4; quoting Ex. 1006 ¶ 25; citing Ex. 2004 ¶¶ 47–49, 51). Patent Owner further asserts that Petitioner's declarant Dr. Randall agrees that the thickness of the filler material would double as a result of the terminal folding process. *See id.* at 49 (citing Ex. 1001 ¶ 154); *see also* Sur-reply 12 (alluding to this argument to assert that Nakamura's insulation layer is cured and hardened prior to bending the electrodes).

In reply to these arguments, Petitioner contends that Patent Owner "misrepresents Dr. Randall's testimony, who never opined that folding

electrodes exactly doubles the thickness of insulation resin in Nakamura." Pet. Reply 21. Petitioner asserts that Dr. Randall instead testifies that the thickness may be reduced depending on parameters of a lamination process. *See id.* at 21–22 (citing Ex. 1044 ¶ 158[8]; Ex. 1001 ¶¶ 156–157).

Also in response to the Petition, Patent Owner argues that Petitioner does not identify any disclosure in Nakamura to support its assertion that the insulation layer is sandwiched and squeezed during a lamination process to create depressions. *See* PO Resp. 49–50 (citing Pet. 19; Ex. 1001 ¶ 105). Patent Owner contends that Nakamura uses lamination to mean "layers" and argues that Nakamura discloses that to make the laminated resistor, the insulation layer comes into close contact with itself so that the thickness above the terminals doubles. *See id.* at 50 (citing Ex. 2004 ¶¶ 48, 124).

In reply, Petitioner asserts that Nakamura discloses forming an uncured insulation layer before folding electrodes. *See* Pet. Reply 8–9 (citations omitted). Petitioner argues, "Nakamura's required thickness is the application thickness of the [uncured] resin, not the cured and hardened thickness of the insulation layer, particularly because the laminated structure has not yet been achieved." *Id.* at 8–9 (citing Ex. 1044 ¶¶ 154–157[9]); *see id.* at 10 (citing Ex. 1006 ¶¶ 25, 29; Ex. 1007 Figs. 2–3). According to Petitioner, "the insulation resin is uncured and unhardened, because electrodes 12 still need to be folded to sandwich the layer of insulation resin between resistor 11 and electrodes 12." *Id.* at 10–11 (citing Ex. 1006 ¶¶ 25,

[8] The correct citation for Ex. 1004 ¶ 158 appears to be Ex. 1004 ¶ 126.
[9] The correct citation for Ex. 1004 ¶¶ 154–157 appears to be Ex. 1004 ¶¶ 122–125.

29; Ex. 1044 ¶¶ 152, 155, 159[10]). Petitioner further asserts, "[f]olding electrodes 12, however, does not by itself form a 'laminated structure.' Rather, the folding step *must be* followed by a lamination process to complete the disclosed 'laminated structure,' in which insulation layer closely adheres to electrodes and resistor." *Id.* at 11 (emphasis added; citing Ex. 1044 ¶¶ 75–76, 151–152, 155[11]; Ex. 1001 ¶¶ 106–112).

Petitioner also reiterates that Nakamura discloses a laminated structure and argues that, contrary to Patent Owner's arguments (citing PO Resp. 30, 35), Nakamura's laminated structure requires more than mere contact between the component layers because Nakamura explicitly requires that the resistor section is secured to the electrode sections through an insulation layer. *See* Pet. Reply 9–10 (quoting Ex. 1006, claim 1; Ex. 2002, claim 1; citing Ex. 1006, claim 4 (for "fixed"); Ex. 2002, claim 4 (for "fixed"), citing Ex. 1006 ¶¶ 25, 29; Ex. 2002 ¶¶ 25, 29; Ex. 1044 ¶¶ 72–76, 166, 180–183, 229, 234[12]); *see also* Pet. Reply 17 (citing Reply Section IV.B. (Pet. Reply 9–12, arguing that Nakamura teaches a laminated structure in which the component insulation layer, electrodes, and resistor must be bonded to each other so as to be secured or fixed). According to Petitioner, Nakamura discloses no securing means other than close adhesion or close contact. *See id.* at 10 (citing Ex. 1006 ¶¶ 25, 29; Ex. 2002 ¶¶ 25, 29; Ex.

[10] The correct citation for Ex. 1004 ¶¶ 152, 155, 159 appears to be Ex. 1004 ¶¶ 120, 123, 127.
[11] The correct citation for Ex. 1004 ¶¶ 151–152, 155 appears to be Ex. 1004 ¶¶ 119–120, 123.
[12] The correct citation for Ex. 1004 ¶¶ 166, 180–183, 229, 234 appears to be Ex. 1004 ¶¶ 134, 148–151, 197, 202.

1044 ¶¶ 72–76); *see also id.* at 12 (arguing securing involves more than mere stacking; citing Ex. 1044 ¶¶ 72–76). Petitioner contends,

> By definition, a "laminated structure" is:
> [M]ade up of layers of materials ***bound together*** to form complex shapes or to produce a material with high strength for its weight. Laminates are thin sheets of material ***bound together by an adhesive and, after heat and/or pressure treatment (i.e., curing), formed into a structural material***.

Pet. Reply 10 (quoting Ex. 1044 ¶ 167[13]). According to Petitioner, "[t]o form Nakamura's 'laminated structure' in which the component layers are ***bonded so as to be secured or fixed to each other***, curing and hardening of the insulating resin material constituting the insulation layer occurs ***during, not prior to***, the lamination process." *Id.* (citing Ex. 1044 ¶¶ 72, 75–76, 111, 149, 151–152, 154–156, 171–179, 229[14]; Ex. 1006 ¶¶ 106–112). Petitioner asserts that lamination is a well-known process. *See id.* at 11.

Petitioner further contends that, in the laminated structures disclosed in Nakamura, the component layers are bonded to adjacent layers either by way of pressing at elevated temperature or by hot pressing to form a laminated structure wherein each layer is bonded to its associated adjacent layer. *See* Pet. Reply 11 (citing Ex. 1044 ¶ 177[15]). Petitioner asserts that this necessary pressing during the lamination process into the uncured insulation resin produces a depression in the resulting insulation layer. *See*

[13] The correct citation for Ex. 1004 ¶ 167 appears to be Ex. 1004 ¶ 135.
[14] The correct citation for Ex. 1004 ¶¶ 111, 149, 151–152, 154–156, 171–179, 229 appears to be Ex. 1004 ¶¶ 117, 119–120, 122–124, 139–147, 197.
[15] The correct citation for Ex. 1004 ¶ 177 appears to be Ex. 1004 ¶ 145.

id. (citing Ex. 1044 ¶ 208[16]); *id.* at 12 (citing 1044 ¶¶ 91–103, 152, 195–199, 206, 208[17]).

In response to Petitioner's Reply arguments addressing a lamination process, Patent Owner contends that Petitioner's arguments are incorrect because Nakamura does not disclose, and there is no evidence of, a lamination process. *See* Sur-reply 9–10 (citing Ex. 2004 ¶¶ 112–128); *id.* at 12. Patent Owner argues that Petitioner and its declarant Dr. Randall have not provided facts that require a lamination process to take place in Nakamura, or that such a lamination process must necessarily form a depression. *See id.* at 9–10 (quoting *Transclean Corp. v. Bridgewood Servs., Inc.*, 290 F.3d 1364, 1373 (Fed. Cir. 2002); *Cont'l Can*, 948 F.2d at 1269). According to Patent Owner, the only evidence Petitioner cites in support of its contention that any of the alleged lamination processes are "necessary" to form a laminated structure is its expert declarations. *See* Sur-reply 10. Patent Owner contends that the mere possibility that a lamination process *can* be used is not enough to establish that a lamination process *must* be used. *See id*. at 11 (citing Pet. Reply 12). Patent Owner further disputes Petitioner's contention that Nakamura refers to the thickness of the resin when it is applied, not the cured and hardened thickness, because the laminated structure has not yet been achieved. *See id*. at 12 (quoting Pet. Reply 8–9). Patent Owner contends that Petitioner's arguments amount to a contention that the resin must be uncured because of an undisclosed lamination process that Petitioner insists must occur. *See id.*

[16] The correct citation for Ex. 1004 ¶ 208 appears to be Ex. 1004 ¶ 176.
[17] The correct citation for Ex. 1004 ¶¶ 152, 195–199, 206, 208 appears to be Ex. 1004 ¶¶ 120, 163–167, 174, 176.

We are not persuaded that Nakamura's embodiments of Figures 1–4 disclose "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," as recited in claim 1. As discussed above in Section II.B.1.b., we determine that "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," although it is a recitation of a product-by-process, is afforded patentable weight because employing this step imparts distinguishing structure and function to the claimed product. In particular, a product produced by this process has different structure and function than a product in which the terminations are merely folded into contact with the filler because this process results in a product with a filler having reduced air bubbles and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature.

We acknowledge that, as argued by Petitioner, Nakamura's embodiments of Figures 1–3 disclose separation distances of approximately 50 μm to 150 μm and 100 μm to 300 μm between the resistive element and the terminations where the insulation layer is located. *See* Pet. 31–37, 43–44, 48, 55–56. Petitioner, however, does not present persuasive arguments addressing whether Nakamura's embodiments of Figures 1–4 discloses an insulation layer having the structural and functional characteristics imparted by the claimed process step, such as reduced air bubbles and improved thermal conductivity contributing to reduced resistor operating temperature. *See* Pet. 18–22; Pet. Reply 7–13.

We also agree with Patent Owner's general argument that there is no disclosure of a depression formed by the terminations in Nakamura's embodiments of Figures 1–4, and that Nakamura's Figures 1, 2e, and 4 do

not show depressions. *See* PO Resp. 48–49 (reproducing Ex. 1007, Figs. 1, 2e, 4; citing Pet. 19); *id.* at 50; Sur-reply 9. We, however, do not premise our agreement on Patent Owner's contention that Nakamura's Figures 1–4 show the thickness of Nakamura's insulation layer is doubled. *See* PO Resp. 48 (citing Ex. 1006 ¶ 25; Ex. 2004 ¶¶ 47–49, 51). It is well settled "that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue" (*Hockerson–Halberstadt, Inc. v. Avia Group Int'l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000)), and Nakamura is silent regarding the thickness of the insulation layer after the electrodes are folded and whether the drawings are to scale. *See generally* Ex. 1006; Ex. 2002. In addition, we do not agree that Petitioner's declarant Dr. Randall's testimony confirms that the insulation layer is doubled. *See* PO Resp. 48 (quoting Ex. 1001 ¶ 154). As pointed out by Petitioner (*see* Pet. Reply 21–22 (citing Ex. 1044 ¶ 158[18]; Ex. 1001 ¶¶ 156–157)), Dr. Randall testified that the thickness of the insulation layer "is *approximately* doubled," and "would be reduced somewhat." Ex. 1001 ¶ 156 (emphasis added).

We also agree with Patent Owner's arguments that Petitioner's assertions of a lamination process in Nakamura (which would allegedly support an inference of "a depression in the filler") are not supported by the record. We acknowledge that Nakamura discloses: (1) a resistor having a "laminate structure," or "laminated structure," "a compact structure," and "a compact laminate structure"; (2) the resistor section is secured or fixed to the electrode section through an insulation layer; and (3) the electrode sections

[18] The correct citation for Ex. 1004 ¶ 158 appears to be Ex. 1004 ¶ 126.

closely adhere to, or come into close contact with, the insulation layer. *See* Ex. 1006 ¶¶ 1, 8, 9, 11, 14, 21, 25, 27, 29–31, 33, claims 1, 4; Ex. 2002 ¶¶ 1, 8, 9, 11, 14, 21, 25, 27, 29–31, 33, claims 1, 4. We are not persuaded, however, that Nakamura discloses, either explicitly or inherently, the alleged lamination process, or that the alleged lamination process results in a depression. As pointed out by Patent Owner, Nakamura does not disclose a lamination process, nor sandwiching and squeezing during any laminating process. *See* PO Resp. 50; Sur-reply 9–10; *see generally* Ex. 1006; Ex. 2002. The explicit disclosures of Nakamura contradict Petitioner's argument that folding electrodes 12 does not by itself form a "laminated structure," but must be followed by a lamination process to complete the "laminated structure," in which insulation layer closely adheres to electrodes and resistor. *See* Pet. Reply 11 (citing Ex. 1044 ¶¶ 75–76, 151–152, 155[19]; Ex. 1001 ¶¶ 106–112). Specifically, Nakamura discloses the following process for forming a laminated structure:

> an insulation resin . . . is coated on one face side . . . of the resistance metal material 21 so as to form the insulation layer 13 having a thickness . . . . And, ***as a result of*** the electrode sections 12 being turned around the axes which are both ends 11a of the resistor section 11 by an angle of 180^0 in a direction . . . in which the electrode sections 12 approach each other, and being folded (bent), ***a laminated structure is formed*** in which the insulation layer 13 is sandwiched between the resistor section 11 and the electrode sections 12.

Ex. 1006 ¶ 25 (emphasis added). Similarly, Nakamura discloses the following additional process for making the laminated structure:

[19] The correct citation for Ex. 1004 ¶¶ 151–152, 155 appears to be Ex. 1004 ¶¶ 119–120, 123.

> the insulation layer 13 is formed on one face side (a lower face side in Fig. 3) of the produced resistor section 11 . . . . And, a laminated structure, in which the insulation layer 13 is sandwiched between the resistor section 11 and the electrode sections 12, ***may be made by*** bending the electrode sections 12 around the axes of the both ends 11a of the resistor section 11 in a direction (an inward direction) in which the electrode sections 12 approach each other, and by turning the electrode sections 12 by an angle of 90° so as to closely adhere to the insulation layer 13.

Id. ¶ 29 (emphasis added).

Petitioner's cited testimony of Dr. Randall (Ex. 1044 ¶¶ 75–76, 151–152, 155[20]; Ex. 1001 ¶¶ 106–112), to support its argument that the folding step must be followed by a lamination process (*see* Pet. Reply 11), is not supported by a sufficient factual basis. For example, Dr. Randall cites paragraphs 14, 25, 27, 29, and Figures 1–4 of Nakamura in support of his testimony that Nakamura discloses folding the electrodes into the applied insulating resin layer and squeezing or laminating the structure to achieve a laminated structure. *See* Ex. 1044 ¶ 76. Dr. Randall also cites Nakamura's disclosures of: (1) the resistor portion 11 fixed to the electrode portion via an insulation layer, (2) a compact structure, and (3) a laminated structure, as providing a factual basis for testifying that Nakamura's resin is cured during subsequent bending, folding, squeezing, and lamination processing to form a laminated structure. *See* Ex. 1044 ¶ 120 (citing Ex. 2002, code (57), ¶¶ 1, 9, 14, 21, 25, 29). Nakamura does not, however, disclose explicitly squeezing or laminating to achieve a laminated structure (*see generally* Ex. 1006; Ex. 2002), but instead discloses, as highlighted immediately above, the

[20] The correct citation for Ex. 1004 ¶¶ 151–152, 155 appears to be Ex. 1004 ¶¶ 119–120, 123.

laminated structure is made or formed by folding the terminations of the coated resistance material (*see* Ex. 1006 ¶¶ 25, 29). Dr. Randall also cites the '252 Patent disclosure as the underlying factual basis for testifying that: (1) Nakamura uses the same method as the '252 Patent for fixing the resistor to the electrodes through insulation layer; and (2) Nakamura's insulation layer must be cured and hardened after bending, folding, and squeezing, and during the lamination step to produce the compact laminated structure. *See* Ex. 1044 ¶¶ 75, 119. Dr. Randall's citations to the '252 Patent Specification, however, do not provide a sufficient factual basis for testimony addressing the disclosure of Nakamura. Petitioner's additional citations to Dr. Randall's testimony at paragraphs 106–112 of Ex. 1006, directed to Nakamura's embodiment of Figure 5 and to disclosures of bonds or bonding of the laminated structure, do not directly support Petitioner's arguments that Nakamura inherently discloses a lamination process.

In addition, Petitioner, and Dr. Randall's cited supporting testimony, do not provide persuasive explanation or reasoning why the asserted lamination process must be the only process to achieve Nakamura's "laminated structure" including a resistor section secured or fixed to the electrode sections, where the electrode sections closely adhere to or contact the insulation layer. *See* Pet. Reply 9–12, 17–18. Similarly, Petitioner, and Dr. Randall's cited supporting testimony, do not provide persuasive explanation or reasoning why other processes cannot be used to achieve Nakamura's "laminated structure" including a resistor section secured or fixed to the electrode sections, where the electrode sections closely adhere to or contact the insulation layer. *See id.* Accordingly, we give little weight to

Dr. Randall's testimony that there must be a lamination process to achieve Nakamura's "laminated structure."

In sum, Petitioner's arguments and supporting evidence are insufficient to demonstrate that Nakamura inherently discloses a lamination process and an uncured insulation layer prior to the asserted lamination process, and, therefore, insufficient to demonstrate that Nakamura inherently discloses a depression in the insulation layer. *See Schering*, 339 F.3d at 1377. "Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient." *Therasense*, 593 F.3d at 1332 (quoting *Cont'l Can*, 948 F.2d at 1269). We further agree with Patent Owner that, even assuming the asserted lamination process was somehow inherently disclosed in Nakamura, Petitioner does not demonstrate that the asserted lamination process necessarily requires pressure. *See* Sur-reply 9–11. In particular, we agree that Petitioner's conclusion that the asserted lamination process must involve either pressing or hot pressing is undermined by Petitioner's definition for a laminated structure that involves heat, pressure, *or* heat and pressure. *See id.* at 10–11 (citing Pet. Reply 9–11).

For all of the foregoing reasons, Petitioner does not show by a preponderance of the evidence that Nakamura discloses, either explicitly or inherently, "a depression in the filler" and "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler," as recited in claim 1.

d. Conclusion

For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting

evidence, we determine that Petitioner has not established by a preponderance of the evidence that claim 1 and claims 2–11 dependent therefrom are unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura.

3. Unpatentability of Claims 1–11 under 35 U.S.C. § 103(a)

Petitioner relies upon the disclosures of Nakamura for teaching most of the limitations of claim 1 by citing arguments in the Petition addressing anticipation of the subject matter of claim 1. *See* Pet. 66–67, 69. For this ground, Petitioner implicitly acknowledges that Nakamura does not teach "the filler engaging, and being bonded to the lower surface of the resistive element and bonded at the depression of the filler to the upwardly presented termination surfaces of the first and second terminations," as recited in claim 1. *See id.* at 68–69. Petitioner asserts that it would have been obvious to one of ordinary skill in the art to modify the teachings of Nakamura to "ensure that the gap filling materials completely cover (i.e., wet or engage) at least the upper presented surface of the terminals as well as the lower presented surface of the resistive element," and "bond said filler materials to the lower presented surface of the resistive element as well as to the upwardly presented surface of each of the terminals to the gap filler material(s)." *Id.* at 69 (citing Ex. 1001 ¶ 84).

Petitioner's assertions that the subject matter of claim 1 would have been obvious over the teachings of Nakamura do not address the deficiencies of Nakamura's teachings identified above in Section II.D.2.c., with respect to "a depression in the filler" and "the upwardly presented termination surfaces of the first and second terminations forming a depression in the filler." *See* Pet. 66–69. Accordingly, for all of the foregoing reasons

identified above in Section II.D.2.c., we are not persuaded that Petitioner has established by a preponderance of the evidence that claim 1 and claims 2–11 dependent therefrom are unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art."

4. Unpatentability of Claims 15–18 under 35 U.S.C. §§ 102(a), 103(a)

a. Claim 15: "A method for making an electrical resistor including first and second opposite ends . . . a first termination . . . and a second termination"

Petitioner asserts that Nakamura discloses "[a] method for making an electrical resistor," as recited in independent claim 15, based on Nakamura's disclosure of a method of making a metal plate resistor. *See* Pet. 49 (citing Ex. 1006, code (57); Ex. 1007, Figs. 1, 5). Petitioner contends that Nakamura discloses "including first and second opposite ends, and an upper surface and a lower surface," as recited in independent claim 15, based on Nakamura's disclosure of a resistor having a resistive element 11, 46 having opposite ends and upper and lower surfaces. *See id.* (citing Ex. 1001 ¶ 101; Ex. 1007 Figs. 1, 5d). Petitioner further asserts that Nakamura discloses "a first termination extending from the first end of the resistance element; and a second termination extending form the second element," as recited in independent claim 15. *See id.* at 49–50 (citing Ex. 1001 ¶ 205). Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See* PO Resp. 33–45.

Based on the entire trial record before us, we find that Nakamura teaches "[a] method of making an electrical resistor including first and second opposite ends . . . a first termination . . . and a second termination," as recited in claim 15.

b. Claim 15: "placing a . . . filler in an uncured and unhardened state on the lower surface of the resistance element; bending the first and second terminations downwardly . . . ; forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state"

Petitioner contends that Nakamura discloses "placing a thermally conductive and electrically non-conductive filler in an uncured and unhardened state on the lower surface of the resistance element," as recited in claim 15. *See* Pet. 50–52. Petitioner bases its contentions on Nakamura's disclosures that the insulation layer 13 is formed on one side of the resistor section and that an insulation resin such as polyimide or epoxy is coated on one side to form the insulation layer. *See id.* at 50 (citing Ex. 1006 ¶¶ 25, 29; Ex. 1007, Fig. 3). Petitioner points out that Nakamura discloses making a laminated structure in which insulation layer 13 is sandwiched between resistor section 11 and the electrode sections 12, and where side faces of electrode sections 12 in Figure 3 closely adhere to insulation layer 13. *See id.* at 51 (citing Ex. 1006 ¶ 29). According to Petitioner, a person of ordinary skill in the art "would understand that the filler material is in an uncured and unhardened state when it is applied to the resistive element, and that it remains so until the laminated resistor structure is achieved." *Id.*; Ex. 1001 ¶ 208 (stating the same). Petitioner also contends that a person of ordinary skill in the art "would understand that during this process, the filler material cures, and securely adheres to, or bonds to the lower surface of the resistive element (11) as well as the upper surfaces of the electrodes (terminations) (12) as a POSITA understands that this is a characteristic of laminated structures." Pet. 51; Ex. 1001 ¶ 208 (stating the same). According to Petitioner, a person of ordinary skill in the art "would

understand that close adherence (and thus lamination) does not occur if the filler material is already cured and hardened prior to establishing the laminated structure." Pet. 51–52 (citing Ex. 1002, 1:44–61; Ex. 1001 ¶ 208).

Petitioner asserts that Nakamura discloses "bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element," as recited in claim 15, based on Nakamura's disclosure in Figure 3. *See* Pet. 52–53 (reproducing Ex. 1007, Fig. 3 with annotations; quoting Ex. 1006 ¶ 29; citing Ex. 1001 ¶ 206; Ex. 1006 ¶ 28); *see also id.* at 53 (reproducing Ex. 1007, Fig. 2d with annotations; citing Ex. 1001 ¶ 205; pointing out the structure resulting from a 90^0 bend). Petitioner contends that Nakamura discloses "forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state," as recited in claim 15. *See id.* at 53–55. According to Petitioner,

> A [person of ordinary skill in the art] would understand that Nakamura discloses that the resistor is made by forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state, then the structure is laminated so as to cure and bond the filler to the resistive element as well as the terminations thereby. A [person of ordinary skill in the art] would understand that Nakamura discloses permitting the filler material to cure and harden while in contact with the lower surface of the resistive element and the first and second terminations during lamination.

Id. at 54 (citing Ex. 1001 ¶ 210 (stating the same)).

Patent Owner argues that Nakamura does not teach "bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element" and "forcing the first and second

terminations into contact with the filler material while the filler material remains in the uncured and unhardened state," as recited in independent claim 15, because Nakamura's Figure 3 and Petitioner's translation of Nakamura do not disclose or suggest electrodes being forced into contact with uncured filler material or electrodes squeezed toward the uncured filler. *See* PO Resp. 33–34 (reproducing Ex. 1007, Fig. 3; citing Ex. 1002, 6:27–31; Ex. 2004 ¶¶ 106–111; Ex. 2017, 5; Ex. 2018, 4). According to Patent Owner, "Nakamura merely discloses that 'a laminated structure' "may be made by bending the electrode sections 12 around the axes of both ends 11a of the resistor section 11 in a direction (an inward direction) in which the electrode sections 12 approach each other, and by turning the electrode section 12 by an angle of 90^0 so as to 'close adhere' to the insulation layer 13.'" *See id.* at 34 (quoting Ex. 1006 ¶ 0029).

More specifically, Patent Owner disputes Petitioner's following positions: (1) Nakamura's insulation is uncured because the embodiments of Figures 1–4 allegedly require a lamination process which requires the insulation to be in an uncured state; and (2) after the electrodes come into contact with the uncured filler material, the structure is laminated so as to cure and bond the filler to the resistive element and terminations. *See* PO Resp. 39–40 (citing Pet. 54; Ex. 2010, 31:15–32:11). Patent Owner argues that Petitioner provides no explanation regarding how to laminate the structure to cure and bond the filler. *See id.* at 40. According to Patent Owner, "[t]here is nothing in Nakamura to support Petitioner's interpretation of 'lamination' and how such a process would be applied to a three-dimensional structure." *Id.* at 42.

Patent Owner further contends that Nakamura uses lamination to describe a layered object. *See* PO Resp. 42 (citing Ex. 2004 ¶¶ 124, 126). According to Patent Owner, Nakamura makes it clear that laminated structure refers to a layered object by "stating explicitly that the electrodes are folded under the insulation to form the laminated structure." *Id.* (citing Ex. 1006 ¶¶ 25, 29; Ex. 2004 ¶ 122); *see id.* at 34 (citing Ex. 1006 ¶ 29, arguing Nakamura's laminated structure is made by bending the electrode sections). Patent Owner reasons, "[h]ad Nakamura intended to disclose a more specific lamination process using heat and pressure, it would necessarily have disclosed heat, pressure, and dwell times to make the resistor to enable the disclosure, but such information is conspicuously absent." *Id.* at 42 (citing Ex. 2004 ¶ 123).

In reply, Petitioner reiterates that Nakamura discloses a "laminated structure." *See* Pet. Reply 20 (citing Reply Sections IV.B. (Pet. Reply 9–12 (addressing "forming a depression in the filler" recited in claim 1) and V.B. (Pet. Reply 17–18 addressing "bond" recited in claim 1). Petitioner asserts that a person of ordinary skill in the art "would understand that curing and hardening of the insulating resin material constituting the insulation layer occurs ***during, not prior to***, lamination." *Id.* at 18 (citing Ex. 1044 ¶¶ 72, 75–76, 111, 149, 151–152, 154–156, 229[21]) *see also id.* at 10 (citing Ex. 1044 ¶¶ 72, 75–76, 111, 149, 151–152, 154–156, 171–179, 229[22]; Ex. 1001 ¶¶ 106–112 similar argument). Petitioner further contends that "premature

[21] The correct citation for Ex. 1004 ¶¶ 149, 151–152, 154, 156, 229 appears to be Ex. 1004 ¶¶ 117, 119–120, 122–124, 197.
[22] *See id.*

curing and hardening of the insulation resin would preclude the formation of the laminated structure, in which the layers are "secured" or "fixed" to each other. *See id.* at 18 (citing Ex. 1044 ¶ 229[23]). Similarly, Petitioner argues, "Nakamura's required thickness is the application thickness of the [uncured] resin, not the cured and hardened thickness of the insulation layer, particularly because the laminated structure has not yet been achieved." *Id.* at 8–9 (citing Ex. 1044 ¶¶ 154–157[24]); *see id*. at 10 (citing Ex. 1006 ¶¶ 25, 29; Ex. 1007 Figs. 2–3).

In response to Petitioner's arguments regarding a lamination process, Patent Owner asserts that Petitioner's lamination theory is predicated on the assumption that Nakamura's insulation layer in not cured and hardened when the electrodes are bent. *See* Sur-reply 12. Petitioner asserts Patent Owner's arguments amount to a contention that the resin must be uncured because of an undisclosed lamination process that Petitioner insists must occur. *See id.* Patent Owner contends that there is no evidence of an alleged lamination process. *See id.*

For the same reasons as those explained above in Section II.D.2.c.(2) addressing Petitioner's Reply arguments in Section (IV)(B) (Pet. Reply 9–12), we are not persuaded that Petitioner shows by a preponderance of the evidence that Nakamura discloses, either explicitly or inherently, the lamination process asserted by Petitioner. Therefore, we also are not persuaded that Petitioner shows by a preponderance of the evidence that Nakamura explicitly or inherently discloses an uncured and unhardened

[23] The correct citation for Ex. 1004 ¶ 229 appears to be Ex. 1004 ¶ 197.
[24] The correct citation for Ex. 1004 ¶¶ 154–157 appears to be Ex. 1004 ¶¶ 122–125.

insulation layer prior to and during folding of the electrodes predicated on Petitioner's assertion that Nakamura discloses a lamination process.

In response to the Petition, Patent Owner also argues that Nakamura's insulation layer is cured and hardened before the electrode sections are rotated because Nakamura's insulation layer is doubled. *See* PO Resp. 36–37. Specifically, Patent Owner contends, "Petitioner's own statements and arguments confirm that Nakamura's insulation layer is cured and hardened before the electrode sections are rotated." *Id.* at 36. Patent Owner asserts that Petitioner argues regarding Nakamura's Figure 2, that thickness of the filler material would double as a result of the terminal folding process. *See id.* at 36–37 (quoting Pet. 32); *see id.* at 35 (similar argument; citing Pet. 32; Ex. 1001 ¶ 154). Patent Owner contends that Nakamura's Figures 1, 2, and 4 show the folded insulation layer 13 is doubled where the insulation layers are brought together to overlap, and a single layer in the middle where the insulation layers do not overlap. *See id.* at 37. According to Patent Owner, "[e]ven it Petitioner w[as] correct, and 'lamination pressure' w[as] applied (there is no evidence of this), Petitioner still agrees the thickness would essentially remain double." *See id.* (citing Pet. 33; Ex. 2004 ¶ 48). Patent Owner reasons that, based on Petitioner's argument, for the thickness of Nakamura's insulation layer to remain double after the electrode rotating process or any alleged lamination process, the insulation layer must be cured and hardened, and further reasons that otherwise the uncured insulation material would ooze together and/or squeeze out, rather than double in thickness. *See id.* Patent Owner also contends that if Nakamura's insulation was not already cured and hardened before folding or bending of the electrodes, then any undesired pulling sticking, dripping, smearing,

expanding, shrinking, etc., could prevent the thickness from doubling. *See id.* (citing Ex. Ex. 2004 ¶¶ 64–65). Patent Owner argues that Petitioner provides no explanation of how the thickness of Nakamura's insulation layer would remain doubled if the insulation layer was in an uncured state during the electrode rotating process. *See id.*

In reply, Petitioner contends that Patent Owner misrepresents Dr. Randall's testimony, who never opined that folding electrodes exactly doubles the thickness of insulation resin in Nakamura. *See* Pet. Reply 21. According to Petitioner, "Dr. Randall stated that insulation layer's thickness may be reduced depending on the parameters of the lamination process." *Id.* at 21–22 (citing Ex. 1044 ¶ 158[25]; Ex. 1001 ¶¶ 156–157).

We do not agree with Patent Owner that Nakamura discloses the insulation layer is cured and hardened before the electrodes are folded on the basis that Nakamura discloses the insulation layer is doubled in thickness. Nakamura is silent regarding the thickness of the insulation layer after the electrodes are folded, and is silent regarding whether Nakamura's drawings are to scale. *See generally* Ex. 1006; *see Hockerson–Halberstadt*, 222 F.3d at 956 ("[P]atent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue."). We agree with Petitioner that Patent Owner misrepresents Petitioner's arguments and Dr. Randall's testimony regarding the thickness of the insulation layer after folding of the electrodes. *See* Pet. Reply 21–22. In contrast to Patent Owner's assertions, Petitioner argues and Dr. Randall testifies that the thickness of the insulation

[25] The correct citation for Ex. 1004 ¶ 158 appears to be Ex. 1004 ¶ 126.

layer "is *approximately* doubled," and "would be reduced somewhat." *See* Pet. 33; Ex. 1001 ¶ 156.

In response to the Petition, Patent Owner also contends, "Petitioner attempts to rewrite Nakamura based on the purported understanding of a POSITA" and "concludes that 'a POSITA would understand that the filler material is in an uncured and unhardened state when it is applied to the resistive element, and that it remains so until the laminated resistor structure is achieved.'" PO Resp. 36 (quoting Pet. 51; citing Pet. 59; Ex. 2010, 31:15–32:11). Patent Owner contends that Petitioner's conclusion is contradicted by Nakamura's teaching that the insulation layer is formed before any rotating of the electrode segments. *See id.* Patent Owner contends that "Nakamura discloses that the insulation layer applied to the resistive material is formed (*i.e.*, cured and hardened) ***before*** the electrodes are bent." *See id.* at 35. Patent Owner contends, "like the prior art disclosed by the inventors (Ex. 1002, Fig. 2, 1:44–61) and the prior art differentiated in the prosecution history, the Nakamura electrodes come into contact with the ***formed*** insulation layer 13 rather than the uncured insulation resin." *Id.* at 36 (citing Ex. 1002, Fig. 2, 1:44–61). Patent Owner also points out that Nakamura does not include any disclosure of insulation oozing around the side edges or ends of the electrodes, or preventing air bubbles, or of depressing the insulation layer. *See id.* (citing Ex. 1002, 6:14–18, 6:61–64).

Petitioner disputes Patent Owner's contention that Nakamura's disclosure of coating an insulation resin to form the insulation layer 13 means the insulation layer is necessarily cured and hardened before electrodes 12 are bent. *See* Pet. Reply 8 (citing PO Resp. 34–35). Petitioner contends that it is improper to equate "formed" with curing or hardening.

See id. According to Petitioner, the word "form" by way of Nakamura's insulation layer means to give a particular shape to the insulation layer, which Petitioner contends is supported by other disclosures of "form" in Nakamura. *See id.* (citing Ex. 1044 ¶¶ 106–110, 145–147, 159[26]). Petitioner also asserts that "a resin is a material that has not yet cured or hardened." *Id.* (citing Ex. 1044 ¶¶ 77, 80–82, 144[27]). Petitioner contends that Nakamura discloses insulation resin is applied to form a layer of insulation resin on resistance metal material 21 or resistor 11. *See id.* at 10 (citing Ex. 1006 ¶¶ 25, 29; Ex. 1007 Figs. 2–3). According to Petitioner, "Nakamura's required thickness is the application thickness of the resin, not the cured and hardened thickness of the insulation layer . . . ." *Id.* at 8–9 (citing Ex. 1044 ¶¶ 154–157[28]). Petitioner also disputes Patent Owner's contention that Nakamura's insulation does not ooze when the electrodes are folded. *See id.* at 9. Petitioner contends that "Nakamura teaches the insulation resin as applied is capable of extending or flowing—in other words, oozing—within the space between the electrodes." *See id.* (citing Ex. 1044 ¶ 90).

We do not agree with Patent Owner that Nakamura discloses that the insulation layer is cured and hardened before the electrodes are rotated based on Nakamura's disclosure of "an insulation resin such as polyimide or epoxy is coated on one face side . . . of the resistance metal materials so as to form the insulation layer 13." Ex. 1006 ¶ 25; *see also* Ex. 1006 ¶¶ 11, 29, 30,

[26] The correct citation for Ex. 1004 ¶¶ 145–147, 159 appears to be Ex. 1004 ¶¶ 113–116, 127.
[27] The correct citation for Ex. 1004 ¶ 144 appears to be Ex. 1004 ¶ 112.
[28] The correct citation for Ex. 1004 ¶¶ 154–157 appears to be Ex. 1004 ¶¶ 122–125.

claim 4 (disclosing forming an insulation layer, and an insulation layer is formed). We agree with Petitioner that Nakamura's disclosures of forming an insulation layer may mean that the insulation layer is given a particular shape, and agree this meaning would be consistent with the remaining disclosures of Nakamura, for example, disclosures that "a compact structure is formed," and "a laminated structure is formed." Ex. 1006 ¶¶ 14, 25; *see* Pet. Reply 8.

We also do not agree with Patent Owner that Nakamura's insulation layer is cured and hardened on the basis of Nakamura failing to disclose uncured insulation oozing around the side edges or ends of the electrodes. *See* PO Resp. 35. We do not agree with Patent Owner's suggested underlying premise that oozing or the ability to ooze is a necessary property of a filler that is uncured and unhardened. Nevertheless, Petitioner's argument that Nakamura teaches the insulation resin as applied is capable of oozing (*see* Pet. Reply 9 (citing Ex. 1044 ¶ 90)) does not persuade us that Nakamura ***does*** disclose an uncured and unhardened insulation layer. Dr. Randall's testimony, cited by Petitioner to support its argument, is not supported by a sufficient factual basis. Dr. Randall directs our attention to Nakamura's disclosure in claim 2 that insulating material is interposed between the pair of electrode sections, and reproduces Figure 4 of the '252 Patent, and, on the foregoing basis, testifies that a person of ordinary skill in the art would understand Nakamura to disclose that the insulating material also extends or flows into the electrode space. *See* Ex. 1044 ¶ 90. Dr. Randall, however, does not explain how Nakamura's disclosure of insulating material interposed between the pair of electrode sections also discloses the insulating material flows or oozes. *See id.* And, the reproduction of

Figure 4 of the '252 Patent Specification cannot provide any basis to support testimony addressing the disclosure of Nakamura. In sum, we give little weight to Dr. Randall's testimony that Nakamura teaches the insulation resin as applied is capable of extending or flowing or oozing within the space between the electrodes, and, therefore, we are not persuaded on this basis that Nakamura discloses the insulation layer is uncured and unhardened.

Petitioner's additional Reply arguments rebutting Patent Owner's assertions that the insulation layer is cured and hardened before the electrodes are rotated (*see* Pet. Reply 8–9), also are insufficient to show that Nakamura inherently discloses "bending the first and second terminations downwardly . . ." and "forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured state," as recited in claim 15. Petitioner's Reply arguments are based on a new assertion that "a resin is a material that has not yet cured or hardened." *See* Pet. Reply 8 (citing Ex. 1044 ¶¶ 77, 80–82, 144[29]). Petitioner's new meaning for a "resin" is not supported sufficiently by the cited evidence. *See* Ex. 1044 ¶¶ 77, 80–82, 112. For example, Dr. Randall does not provide testimony that "resin" would be understood by those with ordinary skill in the art in the context of Nakamura's disclosure as a material that has not yet cured or hardened. *See* Ex. 1044 ¶¶ 77, 80–82, 112. Dr. Randall cites a definition for "resin" from Chambers Dictionary of Science and Technology (Ex. 1018) to support his testimony that a resin is a thermosetting polymer prior to curing, such as an epoxy resin or a polyester resin. *See* Ex. 1044 ¶ 77. Dr. Randall, however, does not explain why his testimony relies on

[29] The correct citation for Ex. 1004 ¶ 144 appears to be Ex. 1004 ¶ 112.

only one of the two dictionary definitions for resin, while discounting the other definition. *See id.* Petitioner's argument that "a resin is a material that has not yet cured or hardened" is undermined by the full dictionary definition for "resin." The full definition for "resin" from Chambers Dictionary of Science and Technology is as follows: "The term resin was widely but loosely used to describe any synthetic plastics material. Now, more precisely, it is applied to a thermosetting polymer prior to curing, eg epoxy resin, polyester resin." Ex. 1018, 3. As a further example, Dr. Randall does not provide testimony to explain how the term "resin" is used in the context of Nakamura's disclosure, for example, whether Nakamura uses the term "resin" loosely in accordance with the first dictionary definition, or more precisely according to the second dictionary definition. Dr. Randall also testifies that, based on Patent Owner's declarant Dr. Hughes's testimony that epoxies generally consist of two parts—a resin and a hardener or curing agent, therefore, an epoxy resin used in Nakamura's disclosed embodiments are not yet cured materials. *See* Ex. 1044 ¶ 80 (citing Ex. 1046, 92:23–93:5). Dr. Randall's testimony, however, is based on Dr. Hughes's understanding of resins, and does not address how the term "resin" is used in the context of Nakamura's disclosure, or how one with ordinary skill in the art would have understood Nakamura's use of the term "resin." For these reasons, we give little weight to Dr. Randall's testimony regarding the meaning for "resin." Accordingly, we are not persuaded that Nakamura discloses the insulation layer is uncured and unhardened prior to and during folding of the electrodes based on Nakamura's use of the term "resin," and Petitioner's newly asserted definition for "resin."

Also in response to the Petition, Patent Owner argues, "[t]o the extent that Petitioner contends that it is inherent that the insulation layer in Nakamura is in an uncured and unhardened state when the electrodes are rotated, Petitioner fails to show that the insulation is ***necessarily*** uncured at the time the electrodes are rotated to form the resistor in Nakamura." PO Resp. 42–43 (citing *In re Montgomery*, 677 F.3d 1375, 1379–80 (Fed. Cir. 2012)). Patent Owner argues that a person of ordinary skill in the art "would understand that the insulation layer could be cured and hardened and enable the electrodes in Nakamura to be bent because there are numerous insulating resins that are flexible, including polyimide and epoxy." *Id.* at 43 (citing Ex. 2004 ¶ 63; Exs. 2020–2026). On this basis, Patent Owner argues that it is not inherent that the insulation layer in Nakamura is in an uncured and unhardened state when the electrodes are rotated. *Id.*

Petitioner disputes Patent Owner's argument based on Dr. Hughes's supporting testimony. *See* Pet. Reply 9 (citing Ex. 2004 ¶ 63). Specifically, Petitioner contends that Dr. Hughes's reliance on KAPTON® as evidence that polyimide insulation resins disclosed in Nakamura can be cured before the electrodes are folded is irrelevant because KAPTON® is not a polyimide resin[30] that can be coated to form an insulation layer to provide close adhesion with electrodes, as taught by Nakamura. *See id.* (citing Ex. 1044 ¶¶ 68–69, 78–79, 221[31]).

[30] Petitioner's argument that KAPTON® is not a polyimide resin also appears to be based on Petitioner's new argument that a "resin" is "a material that has not yet cured or hardened."
[31] The correct citation for Ex. 1004 ¶ 221 appears to be Ex. 1004 ¶ 189.

In response, Patent Owner argues that Petitioner's argument misses the point. *See* Sur-reply 13. According to Patent Owner, the example of KAPTON® shows that cured polyimides can be successfully bent, refuting Petitioner's contention that the insulation layer must be uncured to be bent. *See id.* (citing Ex. 2004 ¶ 63(vi)-(vii)). Patent Owner contends that Petitioner presents no evidence that Dr. Hughes is incorrect. *See id.*

We agree that Petitioner does not show it is inherent that Nakamura's insulation layer is in an uncured and unhardened state at the time the electrodes are rotated. We agree it is possible that Nakamura's insulation layer could be cured prior to and during folding the electrodes because Patent Owner has come forward with evidence to show that a cured and hardened polyimide such as KAPTON® could be used for Nakamura's insulation layer because it remains flexible and can be bent. *See* PO Resp. 43 (citing Ex. 2004 ¶ 63; Exs. 2020–2026); Sur-reply 13 (citing Ex. 2004 ¶ 63(vi)-(vii)). Moreover, even if Nakamura's insulating resin formed on the resistor section is uncured and unhardened prior to folding the electrodes, Nakamura's disclosure is silent regarding any curing of the insulating resin, and the precise timing of when it may be cured—whether it occurs prior to, during, or after, folding of the electrodes. *See* Ex. 1006 ¶¶ 11, 25, 29–30, claim 4; Ex. 2002 ¶¶ 11, 25, 29–30, claim 4. We have considered the competing supporting testimony by the parties' respective declarants, and we are not persuaded that Nakamura inherently discloses the insulating resin applied, coated, and formed on the resistor section is uncured and unhardened just prior to and during the time the electrodes are folded. Although it is possible that Nakamura's insulating resin is uncured and unhardened just prior to and during the time the electrodes are folded,

inherency may not be established by possibilities and probabilities. *See Therasense*, 593 F.3d at 1332.

For all of the foregoing reasons, we are not persuaded that Nakamura discloses, either explicitly or inherently, "bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element" and "forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state," as recited in claim 15.

c. Conclusion

For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that claim 15 and claims 16–18 dependent therefrom are unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura.

5. Unpatentability of Claims 19–21 under 35 U.S.C. § 102(a)

Petitioner presents nearly identical arguments to those addressing independent claim 15 to address the following similar limitations of independent claim 19:

> placing an uncured and unhardened thermally conductive and electrically non-conductive filler on the lower surface of the resistance element; bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element, the first and second terminations each having an upwardly presented surface spaced first and second spaces respectively below the lower surface of the resistance element; squeezing the upwardly presented surfaces of the first and second terminations toward the uncured filler whereby the

> uncured filler will be pressed against the lower surface of the resistance element.

See Pet. 58–61 (reproducing Ex. 1007 Figs. 2d, 3 with annotations; citing Ex. 1006 ¶¶ 25, 29; Ex. 1001 ¶¶ 221, 222, 224).

The parties group together and address the disputes of independent claims 15 and 19. *See e.g.*, PO Resp. 33–47; Pet. Reply 20–22, 24; Sur-reply 21–22, 25–26. For the same reasons as those explained above in Section II.D.4.b. addressing claim 15, we are not persuaded that Petitioner establishes by a preponderance of the evidence that Nakamura discloses, either explicitly or inherently,

> bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element, the first and second terminations each having an upwardly presented surface spaced first and second spaces respectively below the lower surface of the resistance element; squeezing the upwardly presented surfaces of the first and second terminations toward the uncured filler whereby the uncured filler will be pressed against the lower surface of the resistance element.

See Pet. 58–61; Pet. Reply 20–22, 24.

For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that Nakamura discloses, explicitly or inherently, each and every limitation of independent claim 19, and, therefore, claim 19 and claims 20–21 dependent therefrom are unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura.

6. Unpatentability of Claims 15–18 under 35 U.S.C. § 103(a)

Petitioner's arguments addressing the unpatentability of claims 15–18 do not remedy the deficiencies of the teachings of Nakamura identified above in Section II.D.4.b. regarding the limitations "bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element; forcing the first and second terminations into contact with the filler material while the filler material remains in the uncured and unhardened state." *See* Pet. 74–76. For all of the foregoing reasons identified above in Section II.D.4.b., we are not persuaded that Petitioner has established by a preponderance of the evidence that claim 15 and claims 16–18 dependent therefrom are unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art."

7. Unpatentability of Claims 19–21 under 35 U.S.C. § 103(a)

Petitioner's arguments addressing the unpatentability of claims 19–21 do not remedy the deficiencies of the teachings of Nakamura identified above in Sections II.D.4.b. and II.D.5. regarding the limitations

> bending the first and second terminations downwardly to a position spaced below the lower surface of the resistance element, the first and second terminations each having an upwardly presented surface spaced first and second spaces respectively below the lower surface of the resistance element; squeezing the upwardly presented surfaces of the first and second terminations toward the uncured filler whereby the uncured filler will be pressed against the lower surface of the resistance element.

See Pet. 76–77. For all of the foregoing reasons identified above in Sections II.D.4.b. and II.D.5., we are not persuaded that Petitioner has established by

a preponderance of the evidence that claim 19 and claims 20 and 21 dependent therefrom are unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art."

8. Unpatentability of Claims 12–14 under 35 U.S.C. §§ 102(a), 103

a. Claims 12–13

(1) Claim 12: "An electrical resistor comprising: a resistive element having opposite ends, an upper surface and a lower surface; a first termination . . . a second termination"

Petitioner asserts that Nakamura discloses "[a]n electrical resistor comprising: a resistive element having opposite ends, an upper surface and a lower surface; a first termination extending from one of the opposite ends of the resistive element; a second termination extending from the other end of the resistive element," as recited in independent claim 12, based on Nakamura's disclosure of metal plate resistor including resistor section 11 having opposite ends 11a, and upper and lower surfaces, and first and second electrode sections 12 extending from opposite ends 11a of resistor section 11. *See* Pet. 44–45 (reproducing Ex. 1007, Fig. 1 with annotations; citing Ex. 1006, code (57); Ex. 1007, Figs. 1, 5, 5c, 5d; Ex. 1001 ¶¶ 184–186), Pet. 72–73. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that Nakamura discloses "[a]n electrical resistor comprising: a resistive element having opposite ends, an upper surface and a lower surface; a first termination extending from one of the opposite ends of the resistive element; a second termination extending from the other end of the resistive element," as recited

in claim 12. *See* Ex. 1007, Fig. 1; citing Ex. 1006, code (57); Ex. 1007, Figs. 1, 5, 5c, 5d; Ex. 1001 ¶¶ 184–186.

(2) Claim 12: "the first and second terminations each having a second end extending under the lower surface of the resistive element and having a termination surface spaced a predetermined first space away from the resistance element"

Petitioner contends Nakamura discloses "the first and second terminations each having a second end extending under the lower surface of the resistive element and having a termination surface spaced a predetermined first space away from the resistance element," as recited in claim 12, based on Nakamura's disclosure in Figure 1 of first and second electrode sections 12 having second ends extending under the lower surface of resistor section 11, and disclosure in all of Nakamura's embodiments that first and second electrode sections have a termination surface spaced a predetermined space away from the resistive element. *See* Pet. 46 (citing Ex. 1007, Figs. 1, 3, 4; Ex. 1001 ¶¶ 185–187), 73. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that Nakamura discloses "the first and second terminations each having a second end extending under the lower surface of the resistive element and having a termination surface spaced a predetermined first space away from the resistance element," as recited in claim 12. *See* Ex. 1007, Figs. 1, 3, 4; Ex. 1001 ¶¶ 185–187.

(3) Claim 12: "the first and second terminations being electrically disconnected from one another except through the resistive element"

Petitioner asserts Nakamura also discloses "the first and second terminations being electrically disconnected from one another except through the resistive element," as recited in claim 12. *See* Pet. 16–18 (reproducing Ex. 1007, Figs. 1, 5c with annotations; citing Ex. 1007, Figs. 1–5, 5c, 5d; Ex. 1006 [Solving Means], claim 1; Ex. 1001 ¶ 102); Pet. 46 (citing Ex. 1007, Figs. 1, 5c, 5d; Ex. 1001 ¶ 102), Pet. 73. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that Nakamura discloses "the first and second terminations being electrically disconnected from one another except through the resistive element," as recited in claim 12. *See* Ex. 1007, Figs. 1–5, 5c, 5d; Ex. 1006 [Solving Means], claim 1; Ex. 1001 ¶ 102.

(4) Claim 12: "a thermally conductive and electrically non-conductive filler . . . engaging the lower surface of the resistive element and the termination surfaces . . . , and being in heat conducting relation to both the resistive element and the first and second terminations . . . ."

Petitioner contends that, as recited in claim 12, Nakamura discloses

> a thermally conductive and electrically non-conductive filler, the filler engaging the lower surface of the resistive element and the termination surfaces of the first and second terminations, and being in heat conducting relation to both the resistive element and the first and second terminations whereby heat will be conducted from the resistive element through the filler to the first and second terminations.

See Pet. 18. Petitioner's assertion is based on Nakamura's disclosure of insulation layer 13 in Figures 1–4 and insulation layer 48 in Figure 5 formed

of insulating resin such as polyimide and epoxy, which fill the spaces between resistor section 11 and two electrode sections 12 in Figures 1–4, and the spaces between resistor section and two electrode sections 47 in Figure 5 and which radiate heat from the resistor section through insulating layer 13, 48 to two electrode sections 12, 47. *See id.* (citing Ex. 1006 ¶¶ 9, 27; Ex. 1007, Fig. 1; Ex. 1001 ¶ 103; Ex. 1002, 4:33–34, 4:48–51, 5:59–56), *id.* at 22–23 (reproducing Ex. 1006, Fig. 1 with annotations; citing Ex. 1006 ¶¶ 1, 27; Ex. 1001 ¶¶ 117–120), *id.* at 46–47 (reproducing Ex. 1007, Fig. 1 with annotations; citing Ex. 1001 ¶¶ 134–135, 189–95), *id.* at 73–74. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that, as recited in claim 12, Nakamura discloses

> a thermally conductive and electrically non-conductive filler, the filler engaging the lower surface of the resistive element and the termination surfaces of the first and second terminations, and being in heat conducting relation to both the resistive element and the first and second terminations whereby heat will be conducted from the resistive element through the filler to the first and second terminations.

See Ex. 1006 ¶¶ 1, 9, 27; Ex. 1007, Fig. 1; Ex. 1001 ¶¶ 103–120, 117, 134–135, 189–195; Ex. 1002, 4:33–34, 4:48–51, 5:59–56.

(5) Claim 12: "the first space having a thickness between the resistive element and the first and second terminations of between 0.0254 mm and 0.254 mm (1 mil and 10 mils)"

Finally, Petitioner contends Nakamura discloses "the first space having a thickness between the resistive element and the first and second terminations of between 0.0254 mm and 0.254 mm (1 mil and 10 mils)," as

recited in claim 12, based on Nakamura's disclosure of two ranges of separation distances between the surface of resistor section and upper surfaces of two electrode sections, one range is from less than 100 μm (~4 mil) to 300 μm (~12 mil) and the other range is from less than 50 μm (~2 mil) to 150 μm (~6 mil). *See* Pet. 30–37 (reproducing Ex. 1007, Figs. 1, 2c, 2d, 3, 5; quoting Ex. 1006 ¶ 25; citing Ex. 1006 ¶ 32; Ex. 1001 ¶¶ 154–162), Pet. 48 (citing Ex. 1006 ¶¶ 25, 32; Ex. 1007, Fig. 4; Ex. 1001 ¶¶ 153–158); Pet. 74. When the prior art discloses a range, the prior art is anticipatory if it describes the claimed range with sufficient specificity such that a reasonable fact finder could conclude that there is no difference in how the invention operates over the claimed range and the range in the prior art. *Atofina v. Great Lakes Chem. Corp.*, 441 F.3d. 991, 999–1000 (Fed. Cir. 2006); *Clear Value, Inc. v. Pearl River Polymers, Inc.*, 668 F.3d 1340, 1345 (Fed. Cir. 2012). We determine there is no difference in operation of the claimed invention based on the range disclosed in the prior art compared to the claimed range. Patent Owner does not dispute Petitioner's contentions addressing this limitation. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that Nakamura discloses "the first space having a thickness between the resistive element and the first and second terminations of between 0.0254 mm and 0.254 mm (1 mil and 10 mils)," as recited in claim 12. *See* Ex. 1007, Figs. 1, 2c, 2d, 3, 4, 5; Ex. 1006 ¶ 25, 32; Ex. 1001 ¶¶ 154–162.

(6) Claim 13: "the first space has a thickness between the resistive element and the first and second terminations of less than 0.1270 mm (5 mils)."

Claim 13 depends from claim 12 and recites, "wherein the first space has a thickness between the resistive element and the first and second

terminations of less than 0.1270 mm (5 mils)." Ex. 1001, 9:34–37. Petitioner contends that Nakamura discloses the limitations of claim 13 based on Nakamura's disclosure that the distance between resistor section 11 and electrode sections 12 is substantially equal to the thickness of insulating layer 13, disclosed as 50 μm to 150 μm, i.e., 1.965 mils to 5.895 mils. *See* Pet. 43–44 (citing Ex. 1007, Fig. 1; Ex. 1006 ¶ 25; Ex. 1001 ¶ 181); Pet. 48 (citing Ex. 1001 ¶¶ 180, 198–199). We determine there is no difference in operation of the claimed invention based on the range disclosed in the prior art compared to the claimed range. *See Atofina*, 441 F.3d. at 999–1000; *Clear Value*, 668 F.3d at 1345. Patent Owner does not present arguments addressing dependent claim 13. *See generally* PO Resp.; *see* Tr. 32:8–12.

Based on the entire trial record before us, we find that Nakamura discloses "wherein the first space has a thickness between the resistive element and the first and second terminations of less than 0.1270 mm (5 mils)," as recited in claim 13. *See* Ex. 1007, Fig. 1; Ex. 1006 ¶ 25; Ex. 1001 ¶¶ 180–181, 198–199.

(7) Preliminary Response Arguments Not Maintained in Response

Patent Owner presented arguments in its Preliminary Response addressing independent claim 12. *See* Prelim. Resp. 23–25, 49–53. In the Institution Decision, we did not agree with Patent Owner's arguments. *See* Dec. 19–20. Patent Owner does not maintain its arguments in its Patent Owner Response. *See generally* PO Resp.; *see also* Tr. 32:8–12 (Counsel for Patent Owner's response regarding claim 12). Accordingly, Patent Owner has waived its arguments addressing the patentability of claim 12. *See In re Nuvasive Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016).

(8) Conclusion

For the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has established by a preponderance of the evidence that claims 12 and 13 are unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura. In addition, "a disclosure that anticipates under § 102 also renders the claim [unpatentable] under § 103, for anticipation is the epitome of obviousness." *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (quotation and citation omitted)). Therefore, for the same reasons as those discussed above with respect to anticipation of claims 12 and 13, we also are persuaded that Petitioner has established by a preponderance of the evidence that claims 12 and 13 are unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art."

b. Claim 14

Claim 14 depends from claim 12 and recites, "wherein the filler is bonded to both the lower surface of the resistance element and the first and second terminals." Ex. 1002, 9:38–40. Petitioner cites its assertions addressing "bonded" in claim 1. *See* Pet. 49 (citing Pet. 19–22, citing Ex. 1006 ¶¶ 6, 7, 27; Ex. 1001 ¶¶ 106–120, 127, 129, 132, 133, 202). The parties also address claim 14 together with claim 1 in the Response, Reply, and Sur-reply. *See* PO Resp. 47–64; Pet. Reply 14–18; Sur-reply 17–21. We note, however, that the "bonded" limitation of claim 14 is broader than the "bonded" limitation of claim 1 because claim 14 does require "*bonded at the depression of the filler to the upwardly presented termination surfaces* of

the first and second terminals," as recited in claim 1. Ex. 1002, 8:23–26 (emphasis added).

Relevant to the broader "bonded" recitation of claim 14, in addressing the "bonded" limitation of claim 1, Petitioner asserts that "Nakamura repeatedly refers to '***securing***' the electrodes to the lower side of the resistor through the insulation layer" and "to the '***laminated structure***' of the resistor, the electrodes, and the insulator, from which one skilled in the art would understand that those components are bonded, adhered, held fast, stuck." Pet. 21 (citing Ex. 1006, code (57), ¶¶ 8, 11; Ex. 1001 ¶¶ 106–112). According to Petitioner,

> [a]s a result of electrode sections 12 being turned around the axes which are both ends 11a of resistor section 11 in which electrode sections 12 approach each other and are folded (bent), a laminated structure is formed in which insulation layer 13 is sandwiched between resistor section 11 and the electrode sections. Insulation layers 13 on the upper faces of electrode sections 12 closely adhere to the insulation layer 13 on the upper face of resistor section 11 as shown in the figure.

Id. at 22 (citing Ex. 1001 ¶¶ 127, 224, p. 118; referring to Figure 2d reproduced with annotations at Pet. 20). Petitioner further argues that Nakamura discloses that the resistor section 11 radiates heat to the electrodes 12 through the insulating layer 13, and argues that this disclosure is consistent with bonding between resistor section 11 and insulating layer 13. *See id.* (citing Ex. 1006 ¶¶ 6, 7, 27; Ex. 1001 ¶¶ 111, 117, 119).

In the Decision on Institution, we determined there was a reasonable likelihood Petitioner would prevail in showing claim 14 is unpatentable "based on Nakamura's disclosure of forming or obtaining a laminated structure." Dec. 21–22 (citing Pet. 19–22, 49).

In response, and pertinent to the "bonded" recitation of claim 14 and Nakamura's embodiments of Figures 1–4 relied upon by Petitioner to address claims 12–14, Patent Owner argues that all of the translations of Nakamura offered by the parties do not use the terms "bond," "bonded," or "bonding." *See* PO Resp. 56 (citing Ex. 1006; Ex. 2001; Ex. 2002; Ex. 2004 ¶ 24). Patent Owner contends that Nakamura demonstrated an awareness and use of a means to securely adhere two metals based on Nakamura's disclosure of a "fusion splice or the like," but chose not to disclose any such means with regard to the insulation layer. *See id.* at 62–63 (citing Ex. 1006 ¶ 26).

Also pertinent to the "bonded" limitation of claim 14 and Nakamura's embodiments of Figures 1–4, Patent Owner argues that there is no disclosure of bonding based on Nakamura's use of the Japanese term "mitchaku." *See* PO Resp. 56. According to Patent Owner, "Petitioner incorrectly translates 'mitchaku' to mean 'closely adhere' and then asserts that because 'bonded' equates with 'firmly adhere,' Nakamura discloses the claimed bonds." *Id.* (citing Pet. 13, 19–21). Patent Owner contends that "mitchaku" does not mean "firmly adhere" but instead means "close contact. *See id.* at 56–57 (citing Ex. 2004 ¶¶ 27–28). In reply, Petitioner vigorously disputes Patent Owner's arguments that "mitchaku" means "close contact" and not "closely adhere" as asserted by Petitioner. *See* Pet. Reply 14–17 (citations omitted). Patent Owner reiterates its proposed construction for the term "bond" as requiring an "interconnection that performs a permanent electrical and/or mechanical function," and argues that the mere existence of some adhesion does not constitute a "bond." *See* PO Resp. 57. In response, Patent Owner

disputes the reliability of Petitioner's translation. *See* Sur-reply 17–19 (citations omitted).

In reply, and pertinent to the "bonded" limitation of claim 14, Petitioner contends that Nakamura teaches a laminated structure in which the component insulation layer, electrodes, and resistor must be bonded to each other so as to be secured or fixed in the manner required. *See* Pet. Reply 17–18 (citing Reply Section IV.B. (Pet. Reply 9–12). Petitioner contends that Nakamura's "disclosed 'laminated structure' requires ***more than mere contact*** between the component layers, as Nakamura explicitly requires that 'the resistor section is ***secured to*** the electrode sections through an insulation layer.'" *See id.* at 9–10 (citing Ex. 1006, claims 1, 4, ¶¶ 25, 29; Ex. 2002, claims 1, 4, ¶¶ 25, 29; Ex. 1044 ¶¶ 72–76, 166, 180–183, 229, 234[32]).

In response to the Reply, and pertinent to the "bonded" limitation of claim 14, Patent Owner contends that Petitioner: (1) offers a new argument in its Reply that Nakamura requires "securing" (or "fixing") of the resistor and electrodes through the insulation layer; and (2) "argues that 'to be secured,' the electrodes, resistor, and insulation layer must be bonded to each other." Sur-reply 19–20 (citing Pet. Reply 17–18). Patent Owner asserts that this argument is circular because Petitioner contends: (1) without citing any teaching of Nakamura that "bonding occurs during lamination;" and (2) "for bonding to occur during lamination, the insulation resin must not be cured and hardened when the electrodes are bent." *Id.* at 20 (citing Pet. Reply 18). Patent Owner further argues that these same

[32] The correct citation for Ex. 1004 ¶¶ 166, 180–183, 229, 234 appears to be Ex. 1004 ¶¶ 134, 148–151, 197, 202.

arguments by Petitioner fail because Nakamura does not show a lamination process, and provides no facts to show that it is inherent that the insulation must be in an uncured state for lamination to take place. *See* Sur-reply 20 (citing Sur-reply Section IV.A.1. (Sur-reply 9–12)). Patent Owner contends that Petitioner's arguments also fail because Nakamura discloses that "the resistor section and the electrode sections are made of a single material," and "[i]f the insulation layer were to bond to this single metal material [] prior to bending, then the resistor, electrodes, and insulation would be 'secured' (via the bonding) without the need for any lamination process." *Id.* (quoting Ex. 1006 ¶ 8). Patent Owner also argues that Petitioner's arguments fail because "the polyimide insulation does not have to be in the uncured state when the electrodes are bent because—as Dr. Hughes testified—the polyimide can be bent after it has cured and hardened." *Id.* (citing Ex. 2004 ¶ 63(vi)–63(vii)).

We acknowledge that none of the translations of Nakamura offered into evidence use the terms "bond," "bonded," or "bonding." *See* PO Resp. 56 (citing Ex. 1006; Ex. 2001; Ex. 2002; Ex. 2004 ¶ 24). Putting aside the parties' dispute over the meaning of the Japanese term "mitchaku," Patent Owner does not dispute (*see generally* PO Resp.) the argument in the Petition that "Nakamura repeatedly refers to '***securing***' the electrodes to the lower side of the resistor through the insulation layer . . . and to the '***laminated structure***' of the resistor, the electrodes, and the insulator." Pet. 21 (citing Ex. 1001 ¶¶ 106–112). We do not agree with Patent Owner that Petitioner improperly presents new arguments in the Reply—that Nakamura requires "securing" (or "fixing") of the resistor and electrodes through the insulation layer, and "to be secured," the electrodes, resistor, and

insulation layer must be bonded to each other." *See* Sur-reply 19–20 (citing Pet. Reply 17–18). Petitioner's Reply argument is consistent with the aforementioned position advanced in the Petition. *Compare* Pet. Reply 17–18, *with* Pet. 21. Although Patent Owner points out that Nakamura discloses a "fusion splice or the like" as a means to securely adhere two metals (*see* PO Resp. 62–63), we do not agree that, based on Nakamura's failure to disclose a specific means for securing or fixing the resistor and electrodes through the insulation layer, Nakamura fails to disclose "the filler is bonded to both the lower surface of the resistance element and the first and second terminals." Taking into account Patent Owner's proposed definition for "bonded" as "an interconnection that performs a permanent electrical and/or mechanical function," we find that, based on Nakamura's disclosures of: (1) the resistor section "secured" or "fixed" to the pair or electrode sections through an insulation layer (*see* Ex. 1006, code (57), claims 1, 4, ¶¶ 8, 11; Ex. 2002, code (57), claims 1, 4, ¶¶ 8, 11); and (2) a laminated structure formed in which the insulation layer 13 is sandwiched between the resistor section and the electrode sections 12 (*see* Ex. 1006 ¶¶ 25, 27, 29; Ex. 2002 ¶¶ 25, 27, 29), Nakamura discloses at least an interconnection that performs a permanent mechanical function, and, therefore, discloses a "bond" in accordance with Patent Owner's proposed construction.

We find misplaced Patent Owner's contentions that Petitioner's argument is circular and fails based on disputes between the parties regarding whether Nakamura discloses a lamination process, curing of the insulation layer, and whether curing occurs before or during folding of the electrodes. *See* Sur-reply 20. Patent Owner's arguments focus on the method(s) of making the "laminated structure" instead of focusing on the

structure disclosed by Nakamura—a laminated structure formed in which the insulation layer 13 is sandwiched between the resistor section and the electrode sections 12, and where the resistor section is "secured" or "fixed" to the pair or electrode sections through the insulation layer. Claim 14 is directed to a product. For these same reasons, we do not agree with Patent Owner that Nakamura does not disclose a bond because Nakamura does not disclose: (1) either explicitly or inherently, that the resin cures (*see* PO Resp. 57–58); and (2) a lamination process (*see* PO Resp. 58–61).

We also do not agree with Patent Owner's arguments that Nakamura does not disclose a bond because, according to Patent Owner, Figure 2 of Nakamura discloses four layers including two separate insulation layers, while the '252 Patent discloses three layers including a single insulation layer (*see* PO Resp. 61–62). Patent Owner's argument is not commensurate in scope with claim 14 because the language of claim 14 does not require a single insulation layer, or otherwise limit the number of layers for the recited structure.

We find that Nakamura discloses "the filler is bonded to both the lower surface of the resistance element and the first and second terminals," as recited in claim 14 and in accordance with Patent Owner's proposed construction for "bond." *See* Ex. 1006 ¶¶ 8, 11, 25, 27, 29, claim 1, claim 4, code (57); Ex. 1007, Fig. 2d; Ex. 2002 ¶¶ 25, 29, claim 1, claim 4; Ex. 1001 ¶¶ 106–116, 127; Ex. 1044 ¶¶ 72–74, 134.

For the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has established by a preponderance of the evidence that claim 14 is unpatentable under 35 U.S.C. § 102(a) as

anticipated by Nakamura. Because a disclosure that anticipates under § 102 also renders the claim unpatentable under § 103 (*see Connell*, 722 F.2d at 1548), for the same reasons as those discussed above with respect to anticipation of claim 14, we also are persuaded that Petitioner has established by a preponderance of the evidence that claim 14 is unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura and "the state of the relevant art."

9. Belated Reply Arguments

Petitioner's Reply presents several new arguments, discussed below, which, for the reasons that follow, we do not consider. A reply may only respond to arguments raised in the corresponding patent owner response. *See* 37 C.F.R. § 42.23. As explained in the Consolidated Trial Practice Guide, "respond" "does not mean proceed in a new direction with a new approach as compared to the positions taken in a prior filing." Patent Trial and Appeal Board Consolidated Trial Practice Guide[33] 74 (Nov. 2019) (citing 37 C.F.R. § 42.23). A reply that raises a new issue or belatedly presents evidence may not be considered. *See id.* For example, a "[p]etitioner may not submit new evidence or argument in reply that it could have presented earlier, e.g. to make out a prima facie case of unpatentability." *Id.* In determining whether a petitioner appropriately advanced its arguments in the reply brief, "we must consider: whether the petitioner's reply brief is responsive to arguments originally raised in its petition; or whether the reply arguments are responsive to arguments raised

[33] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated; *see also* 84 Fed. Reg. 64,280 (Nov. 21, 2019).

in the patent owner's response brief." *Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 705–706 (Fed. Cir. 2020).

Petitioner asserts, for the first time in the Reply, that the term "sandwiched" as used in Nakamura means "squeezing," and, therefore, one with ordinary skill in the art would understand Nakamura's disclosure of a laminated structure that has a sandwiched structure would involve pressing and squeezing. *See* Pet. Reply 20 (citing Reply Sections IV.B. (Pet. Reply 9–12) and V.B. (Pet. Reply 17–18); citing Ex. 1006 ¶¶ 14, 25, 27, 29; Ex. 1004 ¶¶ 195–196, 202–208[34]); Pet. Reply 22. The Petition does not include arguments that the term "sandwiched" means "squeezing." *See generally* Pet.; *but see* Pet. 19 (asserting Nakamura discloses "sandwiched ***and*** squeezed"). Petitioner's new argument is premised on new testimony that "sandwich" means "squeeze." *See* Ex. 1044 ¶ 171. Petitioner also does not identify an argument in the Patent Owner Response to which this new argument is responsive. *See* Pet. Reply 20, 22.

Petitioner's Reply also offers a new position, not presented in the Petition, that the inner bend radii of Nakamura's electrodes 12 are smaller than the thickness of the coated insulation resin resulting in Nakamura's folding of electrodes 12 squeezing the insulation resin and forming a depression. *Compare* Pet. Reply 21–22 (citing Ex. 1006 ¶ 25; Ex. 2002 ¶ 25; Ex. 1044 ¶¶ 92–100, 102–103), *with* Pet. 18–19, 50–55, 58–60. Petitioner's new position is based on new testimony. *See* Ex. 1044 ¶¶ 92–100, 102–103. Petitioner also does not identify an argument in the

[34] The correct citations for Ex. 1004 ¶¶ 195–196, 202–208 appear to be Ex. 1044 ¶¶ 163–164, 170–176.

Patent Owner Response to which this new argument is responsive. *See* Pet. Reply 21.

Finally, Petitioner offers the following new assertion of obviousness, not presented in the Petition:

> The POSITA would have found it obvious to press, whether by forcing into contact or by squeezing, Nakamura's electrodes and resistor into uncured and unhardened insulation layer, so that the component layers could be laminated to bond or closely adhere to each other to produce the laminated structure disclosed in Nakamura, in which the resistor sections are secured or fixed to the electrodes through the insulation layer.

Pet. Reply Br. 22. The Petition, however, does not include this theory of obviousness. *Compare* Pet. Reply Br. 22, *with* Pet. 53–55, 60, 74–77.

10. Conclusion

Petitioner has shown by a preponderance of the evidence that claims 12–14 are unpatentable. Petitioner has not shown by a preponderance of the evidence that claims 1–11 and 15–21 are unpatentable.

III. PATENT OWNER'S CONTINGENT MOTION TO AMEND

A. Introduction

Contingent on the determination that claims 1 and 12 are unpatentable, Patent Owner requests that we cancel claims 1 and 12 of the '252 Patent and replace these claims with proposed substitute claims 22 and 23, respectively. *See* Mot. Amend 1, 3. As discussed above in Section II, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 12 is unpatentable. Therefore, we consider Patent Owner's Motion to Amend. Because we determine that Petitioner has not demonstrated by a preponderance of the evidence that claim 1 is

unpatentable, we need not reach Patent Owner's request to replace claim 1 with proposed substitute claim 22. Accordingly, the analysis that follows focuses on Patent Owner's request to replace claim 12 with proposed substitute claim 23.

Pilot Program Participation

A pilot program for motion to amend practice and procedures became available to all proceedings instituted on or after March 15, 2019. *See* Notice Regarding a New Pilot Program Concerning Motion to Amend Practice and Procedures in Trial Proceedings in Under the America Invents Act Before the Patent Trial and Appeal Board, 81 Fed. Reg. 9497 (March 15, 2019). Pursuant to the Pilot Program, a patent owner may request, in its motion to amend, that the Board issue preliminary guidance after the petitioner files its opposition. *See id.* at 9499, 9500. Preliminary guidance on a motion to amend is not binding on the Board. *See id.* at 9500. After receiving preliminary guidance from the Board, a patent owner may elect to file a revised motion to amend, file a reply to petitioner's opposition and/or the preliminary guidance, or take no action. *See id.*

In the proceeding before us, Patent Owner requested preliminary guidance from the Board in its Motion to Amend. *See* Mot. Amend 2–3. After Petitioner filed its Opposition to the Motion to Amend (Paper 20, "Opp. Mot. Amend"), the Board issued Preliminary Guidance. *See* Paper 21. Patent Owner did not elect to file a revised motion to amend, but instead filed a Reply to Petitioner's Opposition to the Motion to Amend (*see* Paper 23, "Reply Opp. Mot. Amend") to which Petitioner filed a Sur-reply (*see* Paper 27, "Sur-reply Opp. Mot. Amend").

B. Principles of Law

In an *inter partes* review, amended claims are not added to a patent as a matter of right, but rather must be proposed as a part of a motion to amend. 35 U.S.C. § 316(d). "Before considering the patentability of any substitute claims, . . . the Board first must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121." *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 4 (PTAB Feb. 25, 2019) (precedential). Accordingly, we must consider whether: (1) the amendment proposes a reasonable number of substitute claims; (2) the proposed claims are supported in the original disclosure (and any earlier filed disclosure for which the benefit of filing date is sought); (3) the amendment responds to a ground of unpatentability involved in the trial; and (4) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter. *See* 35 U.S.C. § 316(d); 37 C.F.R. § 42.121.

The Board must assess the patentability of proposed substitute claims "without placing the burden of persuasion on the patent owner." *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290, 1328 (Fed. Cir. 2017) (en banc); *see Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 3–4 (PTAB Feb. 25, 2019) (precedential). Subsequent to the issuance of *Aqua Products*, the Federal Circuit issued a decision in *Bosch Automotive Service Solutions, LLC v. Matal*, 878 F.3d 1027 (Fed. Cir. 2017) ("*Bosch*"), as well as a follow-up Order amending that decision on rehearing. *See Bosch Auto. Serv. Sols., LLC v. Iancu*, Order on Petition for Panel Rehearing, No. 2015-1928 (Fed. Cir. 2018). In accordance with *Aqua Products*, *Bosch*, and *Lectrosonics*, Patent Owner does not bear the burden of persuasion to

demonstrate the patentability of the substitute claims presented in the motion to amend. Rather, ordinarily, "the petitioner bears the burden of proving that the proposed amended claims are unpatentable by a preponderance of the evidence." *Bosch*, 878 F.3d at 1040 (as amended on rehearing); *see Lectrosonics*, Paper 15 at 3–4. In determining whether a petitioner has proven unpatentability of the substitute claims, the Board focuses on "arguments and theories raised by the petitioner in its petition or opposition to the motion to amend." *Nike, Inc. v. Adidas AG*, 955 F.3d 45, 51 (Fed. Cir. 2020). The Board itself also may justify any finding of unpatentability by reference to evidence of record in the proceeding. *Lectrosonics*, Paper 15 at 4 (citing *Aqua Products*, 872 F.3d at 1311 (O'Malley, J.)).

C. Analysis

Because the Preliminary Guidance (Paper 21) issued in this proceeding is not binding on the Board, we consider anew Patent Owner's Motion to Amend and Petitioner's Opposition, along with the subsequently filed Reply and Sur-reply. Patent Owner's Reply to Petitioner's Opposition to the Motion to Amend overcame the patentability concerns expressed in the Preliminary Guidance by presenting arguments and supporting evidence that the process steps recited in proposed substitute claim 23 imparts distinguishing structure and function to the claimed product. We begin our analysis by addressing the statutory and regulatory requirements for a motion to amend, followed by addressing the Petitioner's assertions of unpatentability of proposed substitute claim 23.

1. Proposed Substitute Claim 23

Proposed substitute independent claim 23, to replace independent claim 12, is reproduced below with bolded and underlined text showing Patent Owner's amendments:

> 23. An electrical resistor comprising:
>
> a resistive element having opposite ends, an upper surface and a lower surface;
>
> a first termination extending from one of the opposite ends of the resistive element;
>
> a second termination extending from the other of the opposite ends of the resistive element;
>
> the first and second terminations each having a second end extending under the lower surface of the resistive element and having a termination surface spaced a predetermined first space away from the resistance element, the first and second terminations being electrically disconnected from one another except through the resistive element;
>
> a thermally conductive and electrically non-conductive filler, the filler engaging the lower surface of the resistive element and the termination surfaces of the first and second terminations **that are squeezed into the filler prior to curing and hardening the filler,** and being in heat conducting relation to both the resistive element and the first and second terminations whereby heat will be conducted from the resistive element through the filler to the first and second terminations; and
>
> the first space having a thickness between the resistive element and the first and second terminations of between 0.0254 mm and 0.254 mm (1 mil and 10 mils).

2. Reasonable Number of Substitute Claims

We determine that Patent Owner's proposal to substitute a single claim for challenged independent claim 12 (*see* Mot. Amend 3–4) meets the requirement for a reasonable number of substitute claims. *See* 37 C.F.R.

§ 42.121(a)(3) (establishing a rebuttable presumption that only one substitute claim is needed to replace each challenged claim).

3. Enlargement of Claim Scope

Patent Owner asserts that proposed substitute claim 23 does not seek to enlarge the scope of the originally issued claims because claim language has not been deleted and each proposed claim includes added language that does not broaden the scope. *See* Mot. Amend 1, 3–4. Petitioner does not dispute Patent Owner's contention that proposed substitute claim 23 does not seek to enlarge the scope of the claims of the '252 Patent. *See generally* Opp. Mot. Amend.

Based on the record before us, we determine that proposed substitute claim 23 meet the requirements of 37 C.F.R. § 42.121(a)(2).

4. New Matter / § 112 Support

Patent Owner asserts that the narrowing limitations of proposed substitute claim 23 is supported by the original disclosure of Application 11/066,865 (Ex. 1003, "'865 Application"), from which the '252 Patent issued. *See* Mot. Amend 4–7 (citing Ex. 1003, '865 Application[35] 6:6–8, 6:16–17; 8:28–9:11, 9:29–10:1, Fig. 8D). Petitioner does not dispute Patent Owner's contentions. *See generally* Opp. Mot. Amend.

We have reviewed Patent Owner's citations to the '865 Application for the limitations of proposed substitute claim 23 and agree that proposed substitute claim 23 does not add new matter, and that the '865 Application

[35] Patent Owner indicates that the '865 Application begins at page 70 of Exhibit 1003 and the page references refer to the draft specification. *See* Mot. Amend 5 n.1.

provides sufficient written description support for the limitations of proposed substitute claim 23.

5. Responding to a Ground of Unpatentability

Patent Owner contends that proposed substitute claim 23 responds to Petitioner's reliance on Nakamura because proposed substitute claim 23 recites that the resistor is made by squeezing the terminals into the uncured filler material. *See* Mot. Amend 8. According to Patent Owner, "Nakamura does not disclose such a resistor, nor was it obvious to modify Nakamura to do so." *Id.*; *see also id.* at 8–19 (providing detailed arguments why Nakamura does not anticipate or render obvious the subject matter of the proposed substitute claims). Petitioner does not dispute Patent Owner's contentions that proposed substitute 23 is responsive to the grounds of unpatentability in the Petition. *See generally* Opp. Mot. Amend.

Based on the entirety of the record, we determine that Patent Owner has sufficiently articulated its position for why the added limitations are responsive to the grounds of unpatentability raised in the Petition. *See* Mot. Amend 8–19.

6. Unpatentability of Proposed Substitute Claim 23

Petitioner contends that Patent Owner's request to replace claim 12 with proposed substitute claim 23 should be denied because claim 23 is unpatentable as anticipated by Nakamura, or unpatentable as obvious over Nakamura and Higashitani (Ex. 1026[36]) or Kato (Ex. 1027[37]). *See* Opp. Mot. Amend 1.

[36] US Patent Publication 2004/0156177 A1, published Aug. 12, 2004.
[37] US Patent. No. 6,558,783 B1, issued May 6, 2003.

a. Structure and Function Imparted by a Product-By-Process Claim

The parties dispute whether "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," recited in proposed substitute claim 23, imparts structure to the product-by-process claim. As explained above in Section II.B.1.b., for a product-by-process claim, the determination of patentability is based on the product itself. *See Thorpe*, 777 F.2d at 697. "[I]f the process by which a product is made imparts 'structural and functional differences' distinguishing the claimed product from the prior art, then those differences 'are relevant as evidence of no anticipation' although they 'are not explicitly part of the claim.'" *Greenliant*, 692 F.3d at 1268 (quoting *Amgen*, 580 F.3d at 1370).

Petitioner asserts that the added claim language "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," recited in proposed substitute claim 23, does not define structure, but instead recites the process steps by which the claimed structure is made. *See* Opp. Mot. Amend 24–25 (quoting *Thorpe*, 777 F.2d at 698; *Amgen*, 580 F.3d at 1370 n.14). Petitioner points out that the Federal Circuit held that the phrase "derived from" in a product claim recites a process that does not limit the scope of the claim and is not a basis for distinguishing the claim over the prior art. *See id.* at 25 (citing *Purdue*, 811 F.3d 1345). Petitioner contends that the squeezing step in claim 23 is not a distinguishing limitation. *See id.*

In reply, Patent Owner asserts proposed substitute claim 23 is a product-by-process claim that impart novel structural and functional characteristics to the claimed resistor. *See* Reply Opp. Mot. Amend 1–2.

Patent Owner asserts that the product-by-process claim in *Greenliant* is analogous to proposed substitute claim 23. *See id.* at 4. Patent Owner asserts that the claims at issue in *Greenliant* required a silicon dioxide layer to be "formed" by a chemical vapor deposition technique comprising the use of TEOS, and were found to be written in product-by process form. *See id*. (citing *Greenliant*, 692 F.3d at 1264–65). Patent Owner contends that proposed substitute claim 23 is also a product-by-process claim in which the resistor product is formed by squeezing the terminations. *See id.*

Patent Owner asserts that the '252 Patent explains that the claimed process steps impart novel structural and functional characteristics of the claimed resistor. *See* Reply Opp. Mot. Amend 1–2. According to Patent Owner, "the '252 Patent [Specification] unambiguously teaches that squeezing/bending the termination surfaces into an uncured filler to form a depression imparts distinct structural characteristics to the claimed resistor such as lower operating temperature (due to reduced air bubbles and improved thermal conductivity in the filler material)." *Id.* at 2 (citing Ex. 1002, 6:10–7:21, Fig. 9); *see id.* at 2–3 (quoting Ex. 1002, 6:14–18, 6:57–59), 5 (citing Ex. 1002, 6:10–7:21, Fig. 9). Patent Owner points out that Figure 9 of the '252 Patent illustrates how the resulting structure differs from the prior art by providing data showing that prior art resistor structures that have not undergone the claimed process of squeezing the terminals into uncured filler material have a significantly higher temperature rise than the claimed resistor. *Id.* at 2. Patent Owner contends that the '252 Patent teaches that the squeezing process ensures that that the filler is pressed to a minimal thickness, any air bubbles that would inhibit thermal conductivity are squeezed out, and a bond can be created between the resistive element,

filler, and terminations. *See id.* at 3 (citing Ex. 1002, 6:57–67); *see also id.* at 5 (similar argument, citing Ex. 1002, 6:10–7:21, Fig. 9). Patent Owner contends that proposed substitute claim 23 imparts structural differences in the claimed product just like the product-by-process claims in *Greenliant* differentiated the claimed semiconductor device from the prior art. *See id.* at 2, 6.

In response, Petitioner contends that the process limitations of proposed substitute claim 23 "do not impart any characteristics, structural or functional, to the claimed resistor that might distinguish it over the prior art." Sur-reply Opp. Mot. Amend 2. Petitioner contends that Patent Owner's asserted distinguishing characteristics of "a lower operating temperature, minimal thickness, reduced air bubbles, a bond between the filler and resistive element, and a bond between the filler and the terminations" (quoting Reply Opp. Mot. Amend 5, citing *id.* at 2–3) are attributable to the structural features already recited in the original '252 Patent claims. *See id.* More specifically, Petitioner contends that the lower operating temperature of the claimed resistor is attributable to the resistor's ability to dissipate heat (citing Reply Opp. Mot. Amend 2–3; Ex. 1002, 6:37–52), which is accomplished by: "(i) 'the bonding of filler 28 to both the resistance element 14 and the terminations 24, 25'; (ii) 'the thinness of the filler 28 between 0.0254 mm and 0.254 mm'; and/or (iii) the heat conducting path from the resistance element 14 through the filler 28 and termination 24, 25." Sur-reply Opp. Mot. Amend 2 (quoting Ex. 1002, 6:31–34, 6:52–7:2; citing Reply Opp. Mot. Amend 2–3). Petitioner asserts that each of these features is structural, is recited in original product claim 12, and is taught by the prior art. *See id.*; *see also id.* at 3 (asserting

bonding, thinness of the filler, and heat conducting path are recited in claim 12 and disclosed in Nakamura). Finally, Petitioner asserts that the resistors disclosed in the prior art are also made with reduced air bubbles. *See id.* at 4 (citing Ex. 1045 ¶¶ 21, 24, 39; Ex. 1026 ¶¶ 69–70; Ex. 1027 ¶¶ 15:45–50, 27:54–58, 28:44–64, 29:8–30:14).

We agree with Patent Owner that the '252 Patent discloses that the process of squeezing the first and second terminations into the filler prior to curing and hardening the filler imparts certain structural and functional characteristics to the claimed resistor. *See* Reply Opp. Mot. Amend 1–4. However, we also agree with Petitioner that proposed substitute claim 23 already includes structural limitations directed to: (1) bonding of the filler to the resistance element and the terminations, (2) the thinness of the filler between 0.0254 mm and 0.254 mm, and/or (3) the heat conducting path. *See* Sur-reply Opp. Mot. Amend 2–3.

We are not persuaded by Petitioner's suggestion that lower operating temperatures of the resistor is attributable to heat dissipation, which is attributable ***only*** to: (1) bonding of the filler to the resistance element and the terminations, (2) the thinness of the filler between 0.0254 mm and 0.254 mm, and/or (3) the heat conducting path. A careful reading of the '252 Patent reveals that the lower operating temperature and improved heat dissipation of the disclosed inventive resistor "are ***at least partially due to*** the bonding of filler 28 to both the resistance element 14 and the terminations 24, 25 and also partially due to the thinness of the filler 28 between 0.0254 mm and 0.254 mm." Ex. 1002, 6:52–56 (emphasis added). The '252 Patent further discloses "[***o***]***ther reasons for improved heat dissipation include*** the fact that the terminations are bent into contact with

the filler before the filler 28 is cured and is still pliable," such that: (1) the filler is depressed to a minimal thickness before curing, (2) the filler is allowed conform to resistive element and terminations to prevent air bubbles which inhibit thermal conductivity, and (3) subsequent curing of the filler bonds the resistive element and terminations to the filler to create intimate contact for maximum heat transfer. *Id.* at 6:57–7:2 (emphasis added). Petitioner does not provide persuasive reasoning for discounting Patent Owner's assertion that the squeezing limitation imparts the following additional structural and functional limitations: lower operating temperature due to reduced air bubbles and improved thermal conductivity in the filler material. *See* Sur-reply Opp. Mot. Amend 2–4. Patent Owner's assertion is supported by the '252 Patent Specification. *See* Ex. 1002, 6:37–7:8, Fig. 9.

Accordingly, we determine that although "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler" recites a product-by-process, it is afforded patentable weight because employing this step imparts distinguishing structure and function to the claimed product. In particular, a product produced by this process has different structure and function than a product in which the terminations are merely folded into contact with the filler because this process results in a product with a filler having reduced air bubbles and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature.

b. Unpatentability of Proposed Substitute Claim 23 under 35 U.S.C. § 102(a) as Anticipated by Nakamura

Petitioner asserts that Nakamura discloses each of the limitations of proposed substitute claim 23. *See* Opp. Mot. Amend 21–23 (citing Opposition Section IV.A.6.a. (*id.* at 11–13); citing Ex. 1001 ¶¶ 102, 184–187, pp. 132–134; Ex. 1006, code (57); Ex. 1007, Figs. 1, 5, 5c, 5d). In particular, with respect to "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," Petitioner contends that Nakamura discloses squeezing terminations into the filler before it is cured and hardened. *See id.* at 23 (citingOpposition Section IV.A.6.a. (Opp. Mot. Amend 11–13)). Petitioner contends, "[t]he filler between the resistor and electrodes is ***sandwiched and squeezed*** by the electrodes during the lamination process. This results in close adherence of the filler to electrodes and resistor." *Id.* at 11 (citing Ex. 1001 ¶ 105; Ex. 1006 ¶¶ 25, 29). Petitioner further contends that Nakamura discloses a laminated structure that is compact with insulation sandwiched and interposed between resistor sections and electrode sections, and asserts that the structure is formed by lamination involving pressing because sandwiched means squeezing. *See id*. (citing Ex. 1006 ¶¶ 14, 25, 27, 29; Ex. 1044 ¶¶ 195–96, 202–206[38]); *id.* at 13. Petitioner also contends that when folding the electrodes of Nakamura, a bend radius less than the thickness of the insulation layer would result in squeezing the resin. *See id.* at 12 (citing Ex. 1044 ¶¶ 92–100, 102–103; Ex. 1007, Figs. 1–4); *see id.* at 13 (citing Ex. 1007 Figs. 2(c)-2(e); Ex. 1044 ¶¶ 95–103).

[38] The correct citation to Ex. 1044 ¶¶ 195–96, 202–206 appears to be Ex. 1044 ¶¶ 163–164, 170–174.

In reply, Patent Owner asserts that with respect to the embodiments of Figures 1–4, Nakamura does not disclose an uncured insulation layer when the electrodes are bent, and therefore, Nakamura does not anticipate proposed substitute claim 23. *See* Reply Opp. Mot. Amend 6. Patent Owner also argues that Petitioner cannot show anticipation by arguing that it would be obvious to press by squeezing electrodes into uncured and unhardened insulation to produce Nakamura's laminated structure. *See id.* at 6–7.

In response, Petitioner asserts that it relies on its arguments in its Opposition that Nakamura alone meets the squeezing limitation of proposed substitute claim 23. *See* Sur-reply Opp. Mot. Amend 6.

We are not persuaded by Petitioner's arguments asserting that Nakamura discloses "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," as recited in proposed substitute claim 23, based on an alleged lamination process involving squeezing electrodes into an uncured insulation layer. As explained above in Section III.C.6.a., Patent Owner has come forward with evidence to show that "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler" imparts structural and functional differences in which the filler has, for example, reduced air bubbles, and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature.

We acknowledge that, as argued by Petitioner, Nakamura discloses the insulation layer having a thickness of between 0.0254 mm and 0.0254 mm. *See* Opp. Mot. Amend 23–24. Petitioner's arguments, however, do not address whether Nakamura discloses an insulation layer having the structural

and functional characteristics imparted by the claimed process step such as reduced air bubbles and improved thermal conductivity contributing to reduced resistor operating temperature. *See* Opp. Mot. Amend 11–13, 21–23; Sur-reply Opp. Mot. Amend 6.

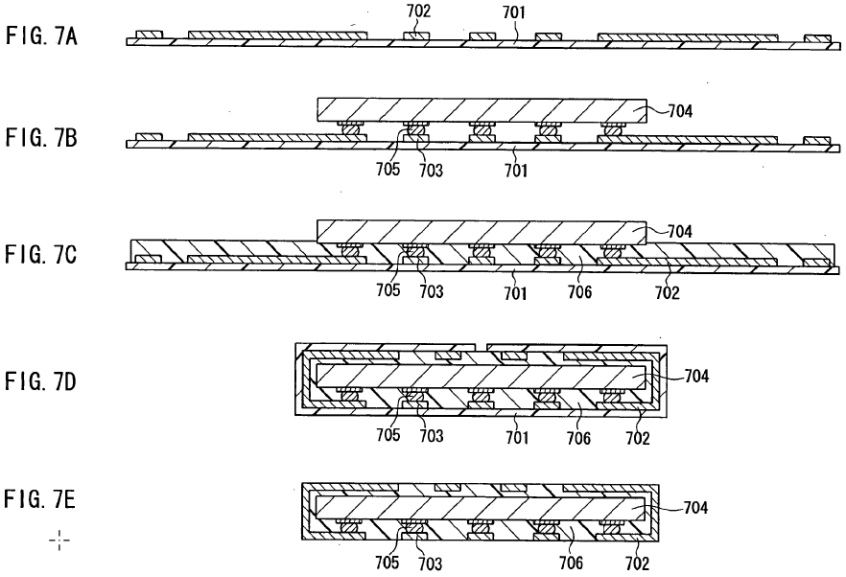
For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that proposed substitute claim 23 is unpatentable under 35 U.S.C. § 102(a) as anticipated by Nakamura.

c. Unpatentability of Proposed Substitute Claim 23 under 35 U.S.C. § 103(a) as Obvious over Nakamura in view of Higashitani

(1) Overview of Higashitani (Ex. 1026)

Higashitani discloses an electronic component package including at least one electronic component (e.g., a resistor), a wiring provided with a terminal portion with which the electronic component is electrically connected, a resin portion that covers at least a part of the electronic component and is for bonding the wiring. *See* Ex. 1026, code (57), ¶¶ 37, 49, 68

Figures 7A through 7E of Higashitani are reproduced below.



Figures 7A through 7E are cross-sectional views showing each of the manufacturing steps of the electronic component package. *See* Ex. 1026 ¶¶ 19, 69. Higashitani discloses wiring 702 with a desired pattern is formed on supporting member 701. *See id.* ¶ 70, Fig. 7A. A semiconductor element 704 (or a resistor) is bare chip mounted on connection terminal 703 that is formed as wiring 702 using solder bump 705. *See id.* ¶ 70, Fig. 7B. Resin 706 is filled among semiconductor element 704, wiring 702, and supporting member 701 as an encapsulating resin. *See id.* ¶ 70, Fig. 7C. Resin 706 is applied so as to extend to a region where semiconductor element 704 is not mounted. *See id.* A folding process is carried out by folding the region where semiconductor element 704 is not mounted so as to cover the semiconductor element 704 with supporting member with the wiring formed thereon. *See id.* ¶ 70, Fig. 7D. Then resin 706 is heated in this state so as to cure the resin. *See id.* "During this heat curing, preferably, the folded sides of the package are secured to a frame member and a pressure is applied gently from a top face of the package so as to

ensure sufficient penetration of the resin 706 into the inside of the package." *Id.* ¶ 70. Surplus resin is allowed to flow out of the end portion of the package that is not subjected to the folding, whereby voids remaining within the package can be removed. *See id.* Wiring 702 is bonded to resin 706 as a result of the heat curing. *See id.* Supporting member 701 that covers the surface of the electrode package is removed. *See id.* ¶ 70, Fig. 7E.

(2) Analysis

Petitioner contends that even if Nakamura does not disclose squeezing terminations into the filler before it is cured and hardened, one skilled in the art would have been motivated by Higashitani to modify Nakamura to include that feature. *See id.* (citing Opposition Section IV.6.b. (Opp. Mot. Amend 13–21)). Petitioner asserts that Higashitani discloses that it is preferable that wiring is embedded in the resin portion to enhance the adhesive strength and therefore the mounting reliability. *See* Opp. Mot. Amend 13 (citing Ex. 1025 ¶ 38). According to Petitioner, "[e]mbedding the terminations in the resin is also disclosed as resulting in a desirably slimmer electronic component package. *Id.* at 13–14 (citing Ex. ¶¶ 31, 44, 83). Petitioner contends that Higashitani prefers fold-pressing the terminations into the resin filler before curing, and allowing excess resin to flow out of the gap between terminations. *See id.* at 14 (quoting Ex. 1026 ¶ 70; citing Ex. 1026 ¶ 69).

Petitioner contends, "[o]ne would be motivated to combine Nakamura and Higashitani because [Higashitani] pertains to electronic packages or components that densely package one or more electronic components or devices such as a resistor or a resistor element." Opp. Mot. Amend 14 (citing Ex. 1026, code (57), ¶¶ 9–12, 32, 37, 49, 64, 68, claims 6, 23); *see id.*

at 15 (citing Ex. 1026, code (57), ¶¶ 8–12, 31, 33, 35–37, 40–41, 44, 53, 60, 62, 64, 67, 70, 83, 99–100; Ex. 1045 ¶¶ 25 (arguing a person of ordinary skill in the art would understand that Higashitani's teachings result in packaged components having high density of mounted components and low mounted profile or mounted height)). Petitioner asserts that Nakamura addresses similar problems because it discloses compact surface mount components having a low profile, which is understood to be a technology driver for the state of the art in the surface mount electronics industry. *See id*. at 15 (citing Ex. 1006, [Technical Field of the Invention], ¶¶ 9, 14, 21, [Effects of the Invention]; Ex. 1045 ¶ 26).

Petitioner further asserts that Higashitani's resin filler and manufacturing method would have been a simple substitution in Nakamura with predictable results, specifically resulting in fixing or bonding Nakamura's resistor to its electrodes by Higashitani's filler because the surfaces of the components would be bonded to the cured and hardened filler, thereby creating a laminated structure. *See id.* 15–16 (citing Ex. 1045 ¶ 27). Petitioner further asserts that the teachings of Nakamura and Higashitani respectively would have motivated one to try the filler and manufacturing method of Higashitani in the device of Nakamura, as it would be a simple substitution with known results. *See id.* at 16 (citing Ex. 1045 ¶ 28).

In reply, Patent Owner argues that Higashitani is not analogous art because Higashitani discloses an electronic component package, but does not disclose the manufacture of electronic components, such as the claimed resistor that would be a component of the Higashitani's semiconductor package. *See* Reply Opp. Mot. Amend 11. Patent Owner further contends

that Higashitani does not disclose any depression, forming a depression in the resin, and there is no disclosure that the "gentle pressure" forms a depression. *See id.* at 11–12.

In response, Petitioner disputes that Higashitani is non-analogous art. *See* Sur-reply Opp. Mot. Amend 7. Petitioner asserts that Higashitani discloses an electronic component package that includes at least one electronic component, and a resin portion that covers at least a part of the electronic component. *See id.* (citing Ex. 1026, claim 1). Petitioner further contends that Higashitani's electronic component may also be a resistor. *See id.* (citing Ex. 1026 ¶¶ 32, 37, 49, 64, 68).

Petitioner further faults Patent Owner for focusing on the process aspect of proposed claim 23, instead of the structure of the claimed resistor. *See* Sur-reply Opp. Mot. Amend 7–8. Petitioner criticizes Patent Owner for failing to address paragraphs 38, 69, and 70 of Higashitani, which were cited in the Opposition. *See id.* at 8–9 (quoting Ex. 1026, 38, 69–70; citing Opp. Mot. Amend 13–14).

Petitioner's arguments and cited supporting evidence do not persuade us that Nakamura in view of Higashitani teaches or suggests the structure and function imparted by "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," as recited in proposed substitute claim 23. As explained above in Section III.C.6.a., Patent Owner has come forward with evidence to show that "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler" imparts structural and functional differences in which the filler has, for example, reduced air bubbles and improved thermal conductivity, and minimal

thickness contributing to reduced resistor operating temperature. It is Petitioner who bears the burden of proving the proposed amended claims are unpatentable by a preponderance of the evidence. *See Bosch*, 878 F.3d at 1040 (as amended on rehearing); *Lectrosonics*, Paper 15 at 3–4.

We acknowledge that, as argued by Petitioner, Nakamura discloses the insulation layer having a thickness of between 0.0254 mm and 0.0254 mm. *See* Pet. Opp. Mot. Amend 23–24. Petitioner's arguments advocating substituting Higashitani's filler and manufacturing method in Nakamura do not address whether the proposed combination would result in a filler having the structural and functional characteristics imparted by the claimed process step such as reduced air bubbles and improved thermal conductivity contributing to reduced resistor operating temperature. *See* Opp. Mot. Amend 13–16, 23; Sur-reply Opp. Mot. Amend 7. Petitioner's remaining undeveloped arguments faulting Patent Owner for not addressing certain paragraphs of Higashitani's disclosures and asserting that the resistors disclosed in the prior art are also made with reduced air bubbles (*see* Sur-reply Opp. Mot. Amend 4, 6) also do not address whether substituting Higashitani's filler and manufacturing method in Nakamura would result in a filler having the aforementioned structural and functional characteristics imparted by the claimed process step.

For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that proposed substitute claim 23 is unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura in view of Higashitani.

d. Unpatentability of Proposed Substitute Claim 23 under 35 U.S.C. § 103(a) as Obvious over Nakamura in view of Kato

(1) Overview of Kato (Ex. 1027)

Kato discloses a curable polyphenylene ether (PPE) resin that exhibits, after curing, "excellent chemical resistance, moisture excellent chemical resistance, moisture resistance, dielectric characteristics, heat resistance, flame retardancy and dimensional stability, so that it can be used as a dielectric, insulating or heat resistant material." Ex. 1027, code (57); *see id.* at 31:18–26. Kato discloses the curable PPE can be used advantageously as a resin composition for forming insulating layers, such as a substrate for a structure having excellent heat removal characteristics. *See id.* at 29:8–13; 31:26–33. Kato further discloses the treatment for curing the curable PPE resin composition is conducted using a press and a desired degree of flowing is achieved before curing so that excellent molding can be achieved. *See id.* at 15:45–50.

(2) Analysis

Petitioner contends that even if Nakamura does not disclose squeezing terminations into the filler before it is cured and hardened, one skilled in the art would have been motivated by Kato to modify Nakamura to include that feature. *See id.* (citing Opposition Section IV.6.b. (Opp. Mot. Amend 13–21)). Petitioner contends that one skilled in the art would have been motivated to combine Nakamura and Kato because both pertain to filler resins to make laminated structures, which have properties that are desirable in the electronics industry. *See* Opp. Mot. Amend 16–17 (quoting Ex. 1027, code (57); citing Ex. 1045 ¶ 42). Petitioner contends the filler resins and lamination manufacturing methods of Kato would have been advantageous

to try in Nakamura's devices because Kato's PPE resin has excellent dielectric properties and insulation properties once cured and hardened, and would exhibit excellent resistance to heat, temperature, and moisture, flame retardancy, and dimensional stability. *See id.* at 17. Petitioner asserts that one skilled in the art would have understood these characteristics to be attractive when applied to laminated surface mount electronic devices. *See id.* (citing Ex. 1045 ¶ 43). Petitioner contends that one skilled in the art would have understood that Kato's resins bond to layers that touch the resin layers after the resin is cured and hardened, when using Kato's manufacturing method, and that this would create a laminated structure. *See id.* at 17–18. Petitioner asserts that one skilled in the art would have been motivated to use Kato's resin and manufacturing method in Nakamura as this would have been a simple substitution with predictable results, simple to try, and obvious to try. *See id.* at 18 (citing Ex. 1045 ¶ 44); Sur-reply Opp. Mot. Amend 9–10 (citing Ex. 1045 ¶ 44). Petitioner contends that one skilled in the art would have understood that using Kato's resin in Nakamura's devices would result in laminated surface mount resistor devices having excellent heat dissipation characteristics, excellent insulating properties in the filler layer, excellent structural stability, flame resistance, and moisture resistance. *See* Opp. Mot. Amend 18 (citing Ex. 1045 ¶ 45); Sur-reply Opp. Mot. Amend 10 (citing Ex. 1045 ¶ 45).

In reply, Patent Owner argues that Kato does not teach or suggest pressing or squeezing the terminations to form a depression. *See* Reply Opp. Mot. Amend 12. In response, Petitioner faults Patent Owner for focusing on the process aspect of proposed claim 23, instead of the structure of the claimed resistor. *See* Sur-reply Opp. Mot. Amend 7–8.

Petitioner's arguments and cited supporting evidence do not persuade us that Nakamura in view of Kato teaches or suggests the structure and function imparted by "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler," as recited in proposed substitute claim 23. As explained above in Section III.C.6.a., Patent Owner has come forward with evidence to show that "the termination surfaces of the first and second terminations that are squeezed into the filler prior to curing and hardening the filler" imparts structural and functional differences in which the filler has, for example, reduced air bubbles and improved thermal conductivity, and minimal thickness contributing to reduced resistor operating temperature. It is Petitioner who bears the burden of proving the proposed amended claims are unpatentable by a preponderance of the evidence. *See Bosch*, 878 F.3d at 1040 (as amended on rehearing); *Lectrosonics*, Paper 15 at 3–4.

We acknowledge that, as argued by Petitioner, Nakamura discloses the insulation layer having a thickness of between 0.0254 mm and 0.0254 mm. *See* Pet. Opp. Mot. Amend 23–24. Petitioner's arguments advocating substituting Kato's resin and manufacturing method in Nakamura do not address whether the proposed combination would result in a filler having the structural and functional characteristics imparted by the claimed process step such reduced air bubbles and improved thermal conductivity contributing to reduced resistor operating temperature. *See* Opp. Mot. Amend 16–18, 23; Sur-reply Opp. Mot. Amend 7. In addition, Petitioner's undeveloped arguments that the resistors disclosed in the prior art are also made with reduced air bubbles (*see* Sur-reply Opp. Mot. Amend 4, 6) do not address whether substituting Kato's filler and manufacturing method in Nakamura

would result in a filler having the aforementioned structural and functional characteristics imparted by the claimed process.

For all of the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that proposed substitute claim 23 is unpatentable under 35 U.S.C. § 103(a) as obvious over Nakamura in view of Kato.

IV. CONCLUSION

For the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has established by a preponderance of the evidence that claims 12–14 of the ’252 Patent are unpatentable, but has not established by a preponderance of the evidence that claims 1–11 and 15–21 ’252 Patent are unpatentable. In addition, for the foregoing reasons, and after having analyzed the entirety of the record and assigning appropriate weight to the cited supporting evidence, we determine that Petitioner has not established by a preponderance of the evidence that proposed substitute claim 23 is unpatentable, and, therefore, we grant in-part Patent Owner’s Motion to Amend.

V. ORDER

Accordingly, it is

ORDERED that, Petitioner has shown by a preponderance of the evidence that claims 12–14 are unpatentable;

ORDERED that, Petitioner has not shown by a preponderance of the evidence that claims 1–11 and 15–21 are unpatentable;

ORDERED that Patent Owner's Motion to Amend is granted in-part with respect to proposed substitute claim 23;

FURTHER ORDERED that we do not reach Patent Owner's Motion to Amend with respect to proposed substitute claim 22; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	**35 U.S.C. §**	**Reference(s)/Basis**	**Claims Shown Unpatentable**	**Claims Not Shown Unpatentable**
1–21	102(a)	Nakamura	12–14	1–11, 15–21
1–21	103(a)	Nakamura, "the state of the relevant art"	12–14	1–11, 15–21
Overall Outcome			12–14	1–11, 15–21

Motion to Amend Outcome	**Claim(s)**
Original Claims Cancelled by Amendment	
Substitute Claims Proposed in the Amendment	22, 23
Substitute Claims: Motion to Amend Granted	23
Substitute Claims: Motion to Amend Denied	
Substitute Claims: Not Reached	22

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