

NOTE: This disposition is nonprecedential.

**United States Court of Appeals
for the Federal Circuit**

RAYTHEON COMPANY,
Appellant

v.

**SONY CORPORATION, SAMSUNG ELECTRONICS
CO., LTD., SAMSUNG ELECTRONICS AMERICA,
INC., SAMSUNG SEMICONDUCTOR, INC.,**
Appellees

2017-1554, 2017-1556, 2017-1557

Appeals from the United States Patent and Trade-
mark Office, Patent Trial and Appeal Board in Nos.
IPR2015-01201, IPR2016-00209, IPR2016-00962.

Decided: April 2, 2018

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Before LOURIE, O'MALLEY, and WALLACH, *Circuit Judges*.
O'MALLEY, *Circuit Judge*.

Raytheon Company (“Raytheon”) appeals from final written decisions in two *inter partes* review (“IPR”) proceedings, in which the Patent Trial and Appeal Board (“Board”) held all claims of U.S. Patent No. 5,591,678 (“678 patent”) unpatentable. *See Sony Corp. v. Raytheon Co.*, IPR2015-01201, 2016 Pat. App. LEXIS 13452 (P.T.A.B. Nov. 30, 2016) (“1201 Decision”); *Sony Corp. v. Raytheon Co.*, IPR2016-00209, -00962, 2016 Pat. App. LEXIS 13045 (P.T.A.B. Nov. 30, 2016) (“209 Decision”). For the following reasons, we *affirm*.

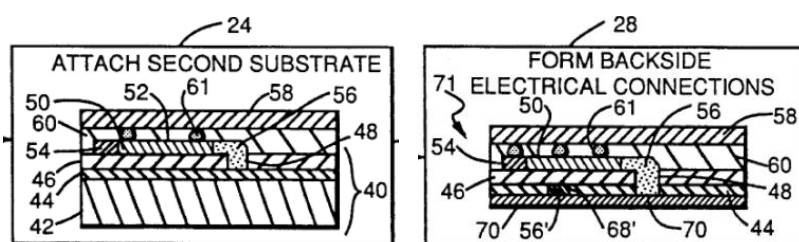
I. BACKGROUND

A. The '678 Patent

Entitled “Process of Manufacturing a Microelectric Device Using a Removable Support Substrate and Etch-Stop,” the '678 patent is directed to purported advances in the manufacture of stacked semiconductors found in everyday electronic devices. The patent expired before the IPR proceedings at issue were initiated, and claims priority to an application filed on January 19, 1993.

Rather than employ a conventional “front-side” fabrication process, whereby microelectronic circuits are

formed and substrates are stacked on top of a wafer, the '678 patent employs a "back-side" process, whereby many of the fabrication steps are performed on the bottom of the wafer. '678 patent, col. 2, ll. 29–37. As shown in box 24 of Figure 1 below, a first, multi-layer substrate 40 containing circuitry 50 is attached to the bottom of a second substrate 58, which provides mechanical support for the wafer and circuitry. *Id.* col. 4, ll. 22–52; *id.* col. 5, ll. 15–44.



Id. fig.1. (boxes 24, 28). Once the wafer and circuitry are supported, the back side of the first substrate is removed. *Id.* col. 5, ll. 45–51. Finally, as shown in box 28 of Figure 1, various back-side electrical connections are formed through the remaining portion of the first substrate. *Id.* col. 6, ll. 10–15, 44–49.

This fabrication method allows electrical connections to be made *through* the device rather than around the sides thereof—making the device more compact—while using the second substrate to protect the fragile wafer and circuitry from damage during fabrication. *Id.* col. 1, l. 50 to col. 2, l. 2; *id.* col. 2, ll. 32–37; *id.* col. 2, l. 59 to col. 3, l. 14. Additional substrates may be sequentially stacked on the back side of the resulting structure to achieve a three-dimensional device containing an arbitrarily large number of layers. *See id.* col. 3, ll. 38–40; *id.* col. 7, ll. 14–17, 60–65.

Dependent claim 5 is representative and recites—through its dependence from claim 1—the method described above using silicon-based materials:

1. A method of fabricating a microelectronic device, comprising the steps of:

furnishing a first substrate having an etchable layer, an etch-stop layer overlying the etchable layer, and a wafer overlying the etch-stop layer;

forming a microelectronic circuit element in the exposed side of the wafer of the first substrate opposite to the side overlying the etch-stop layer;

attaching the wafer of the first substrate to a second substrate; and

etching away the etchable layer of the first substrate down to the etch-stop layer.

....

5. The method of claim 1, wherein the etchable layer is silicon, the etch-stop layer is silicon dioxide, and the wafer is single-crystal silicon.

Id. col. 8, ll. 5–16 (emphasis added), 30–32.

B. The Prior Art

Three prior art references are at issue on appeal: (1) U.S. Patent No. 4,422,091 to Liu (“Liu”), (2) U.S. Patent No. 5,202,754 to Bertin (“Bertin”), and (3) Japanese Unexamined Patent Application Publication No. 64-18248 to Morimoto (“Morimoto”).

Liu issued in 1983 and therefore qualifies as prior art to the ’678 patent under pre-AIA § 102(b). Liu describes a gallium arsenide, multi-layer charge coupled device (“CCD”) for detecting electromagnetic radiation, as well as a method of fabrication. Liu at Abstract; *id.* at col. 2, 7–18.

Bertin issued several months after the priority date of the '678 patent, but was filed sixteen months prior thereto, on September 13, 1991, and therefore nominally qualifies as prior art under pre-AIA § 102(e). Bertin discloses “[a] fabrication method and resultant three-dimensional multichip package” containing several layers of silicon-based material. Bertin at Abstract; *id.* col. 1, ll. 10–15; *id.* col. 1, l. 55 to col. 2, l. 31; *id.* col. 3, ll. 4–46.

Finally, Morimoto published in 1989 and therefore qualifies as prior art under pre-AIA § 102(b). Morimoto discloses “a method for manufacturing semiconductor devices” containing multiple layers. J.A. 115–16.¹ One of those layers is a “supporting silicon substrate,” which Morimoto teaches is removed during the fabrication process. *See* J.A. 116 (explaining that a “two-layer active layer structure is formed” by, among other things, bonding a “supporting silicon substrate” to an insulating film, performing additional steps, and then “*removing* the supporting silicon substrate” (emphasis added)).

C. Procedural History

Appellees Sony Corporation, Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., and Samsung Semiconductor, Inc. (collectively, “Sony”) filed a series of IPR petitions against Raytheon’s ’678 patent, which were consolidated into the two proceedings at issue here.

In its final written decisions, the Board held in relevant part all claims unpatentable under pre-AIA 35 U.S.C. § 103 as obvious over the prior art of record. *See 209 Decision*, 2016 Pat. App. LEXIS 13045, at *33–64; *1201 Decision*, 2016 Pat. App. LEXIS 13452, at *43–69. Sony appealed with respect to claims 5, 13–14, and 16–18

¹ We cite here to the certified English translation of Morimoto included in the joint appendix. *See* J.A. 115–19.

only. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

II. DISCUSSION

Raytheon makes three principal arguments on appeal. First, Raytheon asserts that the Board failed to address its argument that using silicon in Liu’s devices would render them inoperable. Second, Raytheon argues that the Board erred in finding that it failed to antedate Bertin. Third, Raytheon argues that the Board erroneously construed the claim term “second substrate” to encompass Morimoto’s temporary supporting substrate. As explained below, we disagree with Raytheon’s Liu- and Bertin-based arguments and therefore affirm the Board’s obviousness determinations. And, as also explained below, while we agree with Raytheon that the Board’s construction of “second substrate” is erroneous, that issue is rendered moot in view of our holding.

A. The Board’s Liu-Based Findings

The Board found appealed claims 5, 13–14, and 16–18 obvious over Liu in view of other prior art of record. *See 209 Decision*, 2016 Pat. App. LEXIS 13045, at *33–63. Obviousness is a question of law based on underlying factual findings relating to “the scope and content of the prior art, differences between the prior art and the claims at issue, the level of ordinary skill in the pertinent art, and any objective indicia of non-obviousness.” *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007)). We review the Board’s ultimate legal determination of obviousness de novo and its underlying factual findings for substantial evidence. *PPC Broadband, Inc. v. Corning Optical Commc’ns RF, LLC*, 815 F.3d 747, 751 (Fed. Cir. 2016). Substantial evidence is “such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.” *In re Gartside*, 203 F.3d 1305, 1312 (Fed.

Cir. 2000) (quoting *Consol. Edison Co. of N.Y. v. N.L.R.B.*, 305 U.S. 197, 229 (1938)).

As described above, Liu describes a multi-layer CCD for detecting electromagnetic radiation. While Liu acknowledges that silicon devices are “adequate for many applications,” it states that silicon-based devices are unsuitable for “some specific applications,” including “star sensors which require extremely low dark currents and high optical responsivity.” Liu, col. 1, ll. 15–26. Liu teaches that these objectives—which comprise just two of Liu’s six objects of the invention—are “not likely to be realized simultaneously” in silicon-based CCDs. *Id.* col. 1, ll. 25–26; *id.* col. 1, l. 59 to col. 2, l. 6. Liu therefore employs gallium arsenide, rather than silicon, for its devices.

Pointing to these passages, Raytheon argues that using silicon in Liu’s CCDs would defeat Liu’s primary objectives of achieving low dark current and high optical responsivity, which, in turn, would render Liu’s devices inoperable for their intended purpose. Appellant Br. 52–54 (citing *In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984)). For this reason, Raytheon argues, a skilled artisan would not be motivated to combine Liu with secondary references that teach using silicon in semiconductor devices. Raytheon contends that the Board failed to address this argument in its final written decision. We disagree.

Raytheon’s inoperability argument is a slight variation of the argument that the Board squarely addressed. The Board found that Liu’s statement that silicon can hamper performance in CCDs for “some specific applications”—i.e., for star sensors—does not teach away from using silicon in CCDs for *other* applications, including microelectronics applications. See *209 Decision*, 2016 Pat. App. LEXIS 13045, at *43–45. Indeed, as the Board noted, Liu expressly teaches that silicon in semiconductor systems was generally known. *Id.* at *44 (citing Liu, col. 1, ll. 16–17; *id.* col. 5, ll. 9–10). And, relying in part on

Sony's petition and expert's declaration, the Board found that, because "the vast majority of devices [at the time] were made with silicon, Liu's reference to silicon would not have convinced anyone to avoid it except for certain specific applications." *Id.* (internal quotation marks omitted).

That Liu's claimed invention is directed primarily to star sensor applications does not preclude a skilled artisan from combining Liu with silicon-based references for different applications. "A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment." *In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012) (citing *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985)). Indeed, "[o]n the issue of obviousness, the combined teachings of the prior art as a whole must be considered." *EWP*, 755 F.2d at 907. As described above, Liu teaches that silicon-based devices were known. Thus, a skilled artisan cannot be assumed to ignore Liu merely because it is primarily directed to a specific application that is different from the application claimed in the patent at issue. *KSR*, 550 U.S. at 420–21 ("The idea that a designer hoping to make an adjustable electronic pedal would ignore Asano because Asano was designed to solve the constant ratio problem makes little sense."). In view of Liu's teachings and the record evidence, therefore, we conclude that the Board's findings are supported by substantial evidence.

Even if Raytheon were correct that Liu's high optical responsivity and low dark current objectives would be thwarted by using silicon in Liu's devices for microelectronics applications, those objectives comprise just two of Liu's six stated goals. Raytheon does not explain why the resulting device, with just those two objectives frustrated, would be rendered inoperable rather than merely less efficient or less desirable. See *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373,

1381 (Fed. Cir. 2016) (“Although modification of the movable blades may impede the quick change functionality disclosed by Caterpillar, [a] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” (quoting *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006)). Raytheon’s inoperability argument therefore fails on its own terms.

Substantial evidence supports the Board’s finding that a skilled artisan would have been motivated to use silicon material with Liu’s CCD semiconductors in non-star sensor applications. We therefore affirm the Board’s determination that Liu renders appealed claims 5, 13–14, and 16–18 of the ’678 patent obvious.

B. The Board’s Bertin-Based Findings

The Board also found appealed claims 5 and 13 obvious over Bertin in view of Morimoto. *See 1201 Decision*, 2016 Pat. App. LEXIS 13452, at *43–48. Raytheon does not challenge the Board’s finding that Bertin and Morimoto collectively disclose every limitation recited in those claims, or that a skilled artisan would have been motivated to combine the references. Instead, Raytheon argues only that Bertin is not prior art because the inventors reduced to practice the claimed subject matter before Bertin’s filing date. Again, we disagree.

To antedate a prior art reference, a patentee must establish that it invented the subject matter recited in the patent claims before the reference’s priority date. That, in turn, can be established by showing “either an earlier reduction to practice, or an earlier conception followed by a diligent reduction to practice.” *Purdue Pharma L.P. v. Boehringer Ingelheim GmbH*, 237 F.3d 1359, 1365 (Fed. Cir. 2001). A party seeking to establish an actual reduction to practice, as here, must satisfy a two-prong test: (1) the party must construct an embodiment or perform a process that satisfies every element of the claim at issue,

and (2) the embodiment or process must operate for its intended purpose. *In re Steed*, 802 F.3d 1311, 1318 (Fed. Cir. 2015); *Cooper v. Goldfarb*, 154 F.3d 1321, 1327 (Fed. Cir. 1998). “The inventor must also have ‘contemporaneous recognition and appreciation of the invention’ represented by the claims.” *Purdue*, 237 F.3d at 1365–66.

Significantly, an inventor’s testimony alone is insufficient to establish an earlier reduction to practice. *Medi-chem*, 437 F.3d at 1169–71. Instead, a party seeking to prove an actual reduction to practice must proffer evidence corroborating that testimony. *Id.* at 1170. “Sufficiency of corroboration is determined by using a ‘rule of reason’ analysis, under which all pertinent evidence is examined when determining the credibility of an inventor’s testimony.” *Id.*; *Cooper*, 154 F.3d at 1330. Whether a patentee reduced its invention to practice is a mixed question of law and fact. *REG Synthetic Fuels, LLC v. Neste Oil Oyj*, 841 F.3d 954, 958 (Fed. Cir. 2016); *Steed*, 802 F.3d at 1318–20; *Cooper*, 154 F.3d at 1327. We review the Board’s legal conclusions de novo and its underlying factual findings for substantial evidence. *REG*, 841 F.3d at 958; *Steed*, 802 F.3d at 1318–20; *Cooper*, 154 F.3d at 1327.

Much of the parties’ briefing and supporting evidence related to Raytheon’s reduction to practice contention are designated confidential. Accordingly, we do not describe these documents in detail here. For purposes of our analysis, it is sufficient to address Raytheon’s arguments at a high level of generality. During the IPR proceedings, the inventors testified that they reduced to practice the subject matter recited in the claims by the end of 1990—more than nine months before Bertin’s September 1991 filing date—while working on a project for their employer and original assignee, Hughes Aircraft Company.

Raytheon relies on a March 1991 internal report to corroborate that testimony. As the Board found, however,

the report indicates that one of the claimed steps had not yet been completed by December 1990. The report states, for example, that the particular structure referenced in the report was an “*intended* structure,” and that a constituent structure was “*awaiting*” a process step and testing critical to one of the claim limitations.² J.A. 241–42 (emphases added). The Board concluded that these statements imply that Hughes *expected* to complete the claimed step in the future, contrary to the inventors’ testimony. *1201 Decision*, 2016 Pat. App. LEXIS 13452, at *36–38. Based on our careful review of the report, the inventor testimony, and the balance of the record on appeal, we conclude that substantial evidence supports the Board’s finding that the report contradicts the inventors’ testimony and therefore cannot corroborate such testimony.

We reject, moreover, Raytheon’s legal arguments as to why the Board erred. First, Raytheon argues that the Board erred by requiring every point of the reduction to practice be disclosed in the corroborating evidence, which Raytheon contends is inconsistent with the rule of reason standard. Raytheon is correct that corroborating evidence need not disclose each and every aspect of the claimed invention. *See Cooper*, 154 F.3d at 1331 (“[T]he law does not impose an impossible standard of independence on corroborative evidence by requiring that every point of a

² The report also states that Hughes “*will emphasize continuing*” development related to the claimed goals in early 1991, J.A. 242 (emphasis added), but does not indicate that such goals were ever achieved. And, although the report states that Hughes “completed the design and layout of” a particular structure, it states that Hughes only “*continued* development” of a relevant step in the claimed process. J.A. 238; J.A. 241 (emphasis added).

reduction to practice be corroborated by evidence having a source totally independent of the inventor[.]” (internal quotation marks omitted); see also *Fleming v. Escort Inc.*, 774 F.3d 1371, 1377 (Fed. Cir. 2014). But the Board did not require such proof here. As described above, the Board determined that the corroborating evidence *contradicted* the inventor’s testimony and therefore could not be sufficiently corroborative. This conclusion is reasonable in view of the evidence. Cf. *Woodland Tr. v. Flowertree Nursery, Inc.*, 148 F.3d 1368, 1371 (Fed. Cir. 1998) (explaining that, in evaluating the rule of reason, courts take into account “contradiction or impeachment of the witness’ testimony”).

Second, Raytheon argues that the Board erroneously required that the corroborating evidence itself be corroborated. To support that argument, Raytheon points to specific language in the Board’s final written decision in which it stated that “there is no corroborating evidence that” a particular structure described in the report was “constructed or tested in 1990.” *1201 Decision*, 2016 Pat. App. LEXIS 13452, at *36. That statement, however, does not fault Raytheon for failing to proffer evidence that corroborates the corroborating evidence. Instead, it faults Raytheon for failing to proffer evidence that sufficiently corroborates the inventors’ testimony that they completed all claimed steps by the end of 1990. In other words, the Board’s statement merely declares that the report is not itself sufficiently corroborative, and that Raytheon proffered no other evidence to fill the gap.³ Similarly, the

³ Before the Board, Raytheon also relied on an August 1990 invention disclosure and a November 1990 white paper. On appeal, however, Raytheon disclaims reliance on those documents. See Appellant Br. 15 n.8; Oral Argument at 12:28–13:35, *Raytheon Co. v. Sony Corp.* (No. 2017-1554), <http://oralarguments.cafc.uscourts>.

Board did not require that Raytheon's expert's testimony be corroborated. Rather, the Board determined that his testimony was not credible in view of the report's contrary statements.

Third, Raytheon asserts that the Board improperly relied on Sony's attorney argument interpreting the report. This assertion has little force given the plain language of the report, which, on its face, contradicts the inventor testimony.

Substantial evidence supports the Board's findings, and we therefore affirm the Board's determination that Raytheon failed to antedate Bertin, and that Bertin also renders appealed claims 5 and 13 of the '678 patent obvious.

C. The Board's Construction of "second substrate" and Morimoto-Based Findings

In view of our holding above affirming the Board's Liu- and Bertin-based obviousness determinations as to claims 5, 13-14, and 16-18, we need not reach Raytheon's final argument regarding the Board's Morimoto-based obviousness determination as to those same claims. As explained below, however, we agree with Raytheon that the Board's determination on that prior art reference is predicated on an erroneous claim construction.

The Board found appealed claims 5, 13-14, and 16-18 obvious over Morimoto, either standing alone or in view of other prior art of record. *See 1201 Decision*, 2016 Pat. App. LEXIS 13452, at *48-68. That determination was predicated on the Board's construction of the claimed "second substrate" limitation. The Board noted that the term's plain meaning "is merely another substrate (i.e., in

gov/default.aspx?fl=2017-1554.mp3 ("[W]e limited the scope of the evidence that we're relying upon.").

addition to the claimed ‘first substrate’.” J.A. 166 (institution decision). In view of that broad meaning and the claims’ “comprising” transition, the Board determined that the second substrate need not remain part of the final device, and that the claim limitation therefore encompasses Morimoto’s temporary substrate, which is removed during fabrication. *1201 Decision*, 2016 Pat. App. LEXIS 13452, at *10–12, 49–62.

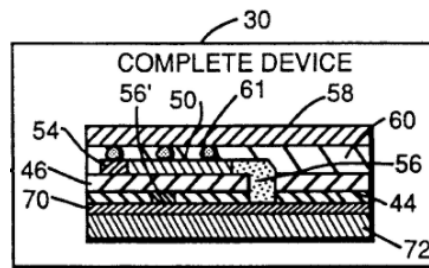
Raytheon argues that the Board’s construction is too broad, and that the correct construction requires that the second substrate remain attached to the device throughout the fabrication process and in the final product. We agree.

Where, as here, an IPR involves an expired patent, the Board gives the claims their plain meaning in accordance with the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). See *Wasica Fin. GmbH v. Cont’l Auto. Sys., Inc.*, 853 F.3d 1272, 1279–80 (Fed. Cir. 2017).

The plain language of the ’678 patent claims states that the wafer of the first substrate is “attach[ed] . . . to a second substrate,” and that a portion of the first substrate is thereafter “etch[ed] away.” ’678 patent, col. 8, ll. 13–16. The claims say nothing about subsequently removing the second substrate, and, in the absence of such language, the reasonable inference is that the substrate is not removed once attached. Further, although the claims make clear that the *first* substrate is partially removed during fabrication via etching, they do not recite similar language with respect to the second substrate. This omission suggests that the second substrate is not, in fact, removed. Cf. *Rodime PLC v. Seagate Tech., Inc.*, 174 F.3d 1294, 1305 (Fed. Cir. 1999) (“Had Rodime intended or desired to claim thermal compensation as a function of the positioning means in the asserted claims, it could have done it explicitly, as in claim 11. The absence of any

such explicit language, however, shows that claims 3, 5, and 8 do not include the function of thermal compensation.”).

The specification amply supports this reading. First, *every* embodiment described in the specification includes the second substrate. Box 30 of Figure 1, for example, depicts a representative embodiment, and shows the second substrate 58 present in the “complete device” manufactured using the claimed method:



'678 patent, fig.1 (box 30). And, although the specification explains that additional layers may be *added* to the device after the second substrate is attached, *see, e.g., id.* col. 6, ll. 50–58, it never suggests that the second substrate may be *removed*. This is particularly significant because the specification emphasizes the temporary nature of *other* layers within the device. *See, e.g., id.* col. 3, ll. 12–14 (“With the circuit element thus supported, the etchable portion of the first substrate is *removed* by etching, down to the etch-stop layer.” (emphasis added)); *id.* col. 5, ll. 47–51 (describing a base layer as being “*temporarily* attached” to the device and eventually “*removed*” (emphasis added)). The specification describes, moreover, a method of fabricating a three-dimensional device containing multiple layers of stacked semiconductors. *See id.* col. 1, ll. 45–49; *id.* col. 2, ll. 37–42; *id.* col. 7, ll. 61–65. Without the second substrate, the device would contain just a single wafer layer and circuitry, which the patent describes as a “two-dimensional structure.” *See id.* col. 1, ll. 15–23 (explaining that a device having only “an electronic

circuit on or near the top surface of a thin substrate wafer . . . is considered a two-dimensional structure in the plane of the substrate wafer”). These passages suggest that the second substrate is not removed.

Second, the specification makes clear that one of the purposes of the second substrate is to protect the fragile wafer during fabrication. *See id.* col. 1, ll. 11–13; *id.* col. 1, l. 58 to col. 2, l. 2; *id.* col. 2, l. 59 to col. 3, l. 14. This purpose is facilitated by transferring the microelectronic circuit elements from the first substrate to the second substrate. *See, e.g., id.* col. 3, ll. 6–8 (“In the present approach, after initial circuit element fabrication on a first substrate structure, the electrical circuit element is transferred to a second substrate structure.”); *see also id.* col. 1, ll. 11–13; *id.* col. 2, ll. 59–61. In other words, the second substrate protects the circuitry and wafer throughout fabrication, even as subsequent layers are added to the back side of the structure. That purpose implies that the second substrate is not temporary, but instead remains within the device. *See id.* col. 3, ll. 2–5 (explaining that, in the absence of a second substrate, “[t]he first substrate cannot simply be removed to permit access to the bottom side of the electrical circuit element, as the assembly could not be handled in that very thin form”). The claims must be read in view of the specification’s “consistent emphasis on this fundamental feature of the invention.” *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306, 1324 (Fed. Cir. 2008).

Third, the only passage in the specification that describes how the second substrate is attached to the wafer states that epoxy glue is preferably used. *See id.* col. 5, ll. 33–38. As the patent explains, such glue, when degassed and cured, “is resistant to chemical attack” and therefore provides a “permanent attachment.” *Id.* In other words, the epoxy glue used in the preferred embodiment ensures that the second substrate remains permanently affixed to the electrical device. Epoxy glue need not be used, of

course, but its reference in the specification suggests that whatever adhesive is used must ensure that the second substrate is permanently attached.

Finally, the specification explains that the second substrate may itself possess circuitry that can be electrically connected to the first substrate's circuitry. *See, e.g., id.* at Abstract; *id.* col. 2, ll. 24–28; *id.* col. 5, ll. 38–44. It would be illogical and inefficient to add circuitry to the second substrate and establish electrical connections between the two substrates, only to remove the second substrate from the device. In sum, the '678 patent specification makes clear that the second substrate is not removed.⁴

The Board did not consider these, or any other, passages of the specification. Instead, it focused solely on the “comprising” transition in the claims' preambles, finding that the open-ended transition allows for subsequent removal of the second substrate. *1201 Decision*, 2016 Pat. App. LEXIS 13452, at *10; J.A. 166–67 (institution decision). It is true, of course, that “the use of ‘comprising’ creates a presumption that the body of the claim is open.” *Crystal Semiconductor Corp. v. TriTech Microelecs. Int'l, Inc.*, 246 F.3d 1336, 1348 (Fed. Cir. 2001); *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997) (“‘Comprising’ is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct

⁴ We recognize that the claims at issue are method claims, and that it would be improper to read apparatus limitations pertaining to the final device into the claims. But we do not embark down that road. Rather, our construction addresses the manner in which the second substrate is attached during the fabrication process. In other words, we interpret the claimed “attaching . . . a second substrate” step to require permanent attachment.

within the scope of the claim.”). But, the term “comprising” does not displace, or otherwise allow one to disregard, the patent specification. As we repeatedly have emphasized, the claims must be read in view of the specification, which “is always highly relevant to the claim construction analysis” and is “the single best guide to the meaning of a disputed term.” *Indacon, Inc. v. Facebook, Inc.*, 824 F.3d 1352, 1355 (Fed. Cir. 2016) (quoting *Phillips*, 415 F.3d at 1315). This fundamental precept is no less true for “comprising” claims than it is for other types of claims. See *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010) (stating that the Board’s construction of a claim reciting a “comprising” limitation must be “consistent with the specification” (internal quotation marks omitted)).

A “comprising” transition, moreover, is “not a weasel word with which to abrogate claim limitations” and “does not reach into each of the . . . steps to render every word and phrase therein open-ended.” *Dippin’ Dots, Inc. v. Mosey*, 476 F.3d 1337, 1343 (Fed. Cir. 2007). Indeed, the word “[c]omprising,” while permitting *additional* elements not required by a claim, does not *remove* the limitations that are present.” *Power Mosfet Techs., L.L.C. v. Siemens AG*, 378 F.3d 1396, 1409 (Fed. Cir. 2004) (emphases added); cf. *In re Skvorecz*, 580 F.3d 1262, 1268 (Fed. Cir. 2009) (“The signal ‘comprising’ does not render a claim anticipated by a device that contains less (rather th[a]n more) than what is claimed.”).

Here, the ’678 patent claims and specification clearly impose a limitation on the claim term “second substrate,” requiring permanent attachment throughout the fabrication process. Morimoto’s additional step of removing the second substrate vitiates that limitation because it, in fact, removes the substrate from the device. Accordingly, the claims cannot be construed so broadly as to encompass such removal. See *In re Varma*, 816 F.3d 1352, 1362 (Fed. Cir. 2016) (explaining that “comprising” claims “do[]

not cover systems whose unclaimed features make the claim elements no longer satisfied”); *Mitsubishi Chem. Corp. v. Barr Labs., Inc.*, 435 F. App’x 927, 935 (Fed. Cir. 2011) (“While claim 3 is open-ended, the addition of new compounds to the composition that would defeat the ‘pharmaceutical’ character of the overall composition would move the composition outside the scope of the claimed invention.”); *cf. Outside the Box Innovations, LLC v. Travel Caddy, Inc.*, 695 F.3d 1285, 1305 (Fed. Cir. 2012) (per curiam) (“The usage [of] ‘comprising’ means that additional components may be present in the device, but does not change the elements that are stated in the claim.”).

Thus, although our holding is not affected by the Board’s error, its interpretation of the word “comprising” as displacing the ’678 patent specification and vitiating the “second substrate” limitation is improper under the *Phillips* standard; indeed, it would be improper under any standard.

III. CONCLUSION

We have considered Raytheon’s remaining arguments and find them unpersuasive. For the reasons stated above, we *affirm* the Board’s ruling invalidating claims 5, 13–14, and 16–18 of the ’678 patent as obvious.

AFFIRMED