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URI COHEN
4147 Dake Avenue
Palo Alto, CA 94306

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte URI COHEN

Appeal 2015-000667
Application 12/471,557¹
Technology Center 2800

Before TERRY J. OWENS, BEVERLY A. FRANKLIN, and
CHRISTOPHER M. KAISER, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134(a) from the decision² of the Primary Examiner rejecting claims 1–17 and 31–37. Final Act. 7–21. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm in part.

¹ Appellant identifies the real party-in-interest as Uri Cohen, the named inventor. Appeal Br. 1.

² Final Office Action, mailed January 10, 2014 (“Final Act.”).

OPINION

Appellant's invention "pertains to the field of electroplating metals or alloys for filling high aspect ratio openings, such as trenches and vias, for semiconductor metallization interconnects, thin film heads, or micromachined Microelectromechanical Systems (MEMS) devices." Spec. 1, ll. 11–14. "In particular, embodiments of the present invention provide improved seed layers for electroplating copper or silver interconnects in semiconductor devices, and methods and apparatus for fabricating such improved seed layers." *Id.* at 1, ll. 14–16.

Claim 1, reproduced below, is representative of the appealed subject matter:

1. A method for depositing two or more [PVD] seed layers for electroplating metallic interconnects over a substrate, the substrate having a patterned insulating layer which includes at least one opening and a field surrounding the at least one opening, the at least one opening having top corners, sidewalls, and a bottom, the field and the at least one opening being ready for depositing one or more seed layers, and the method comprising:

Depositing by a CVD technique a continuous first seed layer over the sidewalls and bottom of the at least one opening using a first set of deposition parameters; and

depositing a second seed layer over the first seed layer using a second set of deposition parameters; wherein:

(i) the second set of deposition parameters includes at least one deposition parameter which is different from any of the deposition parameters in the first set of deposition parameters, or whose value is different in the first and second sets of deposition parameters,

(ii) the thickness of the first seed layer is from about 50Å to not more than 400Å over the field,

(iii) the first and second seed layers are sufficiently thick over the field to enable uniform electroplating across the substrate, and

(iv) after depositing the seed layers, there is sufficient room for electroplating inside the at least one opening.

Appeal Br., Claims App'x A1.

The Examiner rejected claims 1–17 and 31–37 under the first paragraph of 35 U.S.C. § 112 for lack of enablement. Final Act. 7–9. In addition, the Examiner rejected the following claims under 35 U.S.C. § 103(a) as obvious over the following combinations of prior art:

<u>Claims</u>	<u>Prior-Art References</u>
1–3, 6–10, and 31–37	Brown, ³ Shacham-Diamand, ⁴ and AAPA ⁵
4 and 5	Brown, Shacham-Diamand, AAPA, and Liu ⁶
11, 12, and 15	Brown, Shacham-Diamand, AAPA, and Gandikota ⁷
13, 16, and 17	Brown, Shacham-Diamand, AAPA, and Hoinkis ⁸
14	Brown, Shacham-Diamand, AAPA, Hoinkis, and Gandikota

³ Brown et al., U.S. Patent No. 6,187,670 B1, issued Feb. 13, 2001.

⁴ Shacham-Diamand et al., U.S. Patent No. 6,065,424, issued May 23, 2000.

⁵ Applicant-Admitted Prior Art, Spec. 18, ll. 17–24 (cited as identical language in U.S. Patent No. 6,610,151, col. 12, ll. 20–29); Spec. 19, ll. 16–19 (cited as identical language in U.S. Patent No. 6,610,151, col. 12, ll. 61–65); Spec. 20, ll. 1–14 (cited as identical language in U.S. Patent No. 6,610,151, col. 13, ll. 15–35).

⁶ Liu et al., U.S. Patent No. 6,037,258, issued Mar. 14, 2000.

⁷ Gandikota et al., U.S. Patent No. 6,627,542 B1, issued Sept. 30, 2003.

⁸ Hoinkis, U.S. Patent No. 6,146,517, issued Nov. 14, 2000.

Final Act. 8–15.

Appellant, proceeding *pro se*, separately argues each rejection. Appeal Br. 6–83. Accompanying Appellant’s Appeal Brief is an Evidence Appendix comprising five pieces of evidence totaling 167 pages of documents. Appeal Br., Evidence App’x. We consider each of the Examiner’s rejections below.

Lack of Enablement: Claims 1–17 and 31–37

The first paragraph of 35 U.S.C. § 112 requires that “[t]he specification . . . enable any person skilled in the art to which [the claimed invention] pertains, or with which it is most nearly connected, to make and use the [claimed invention].” The Examiner concluded that this requirement was not met with respect to claims 1–17 and 31–37.

First, Appellant argues that it was error for the Examiner to rely on evidence of record that determining “the minimum thickness of a continuous CVD Cu layer is a **critical** variable, and involves more than routine skill.” Final Act. 7 (quoting Second Cheung Declaration (July 18, 2011) ¶ 12). Based on this evidence, the Examiner concluded that, without sufficient disclosure in the Specification, a person of ordinary skill in the art would not have known how to make a continuous CVD layer with a field thickness of 50–250 angstroms. *Id.* at 7–8. The Examiner then noted that the Specification failed to provide “the specific conditions,” such as “pressure, substrate bias, sputtering gas pressure, sputtering gas flow rate, cathodic power, and plasma power density” that could produce the claimed CVD seed layer. *Id.* Given this lack of disclosure and the “large number [of] variables,” the Examiner determined that making the claimed layer would

require undue experimentation, meaning that the enablement requirement of 35 U.S.C. § 112 was not met. *Id.* Appellant argues that the Examiner committed reversible error by relying on this declaration for evidence of lack of enablement when it was intended merely to provide evidence of lack of obviousness. Appeal Br. 7–10. To this end, Appellant argues that obviousness must be proven without using an applicant’s own disclosure, while enablement examines that disclosure to determine whether it is sufficient, making evidence suitable to one determination irrelevant to the other. *Id.* We do not find this argument persuasive. The purpose of the Second Cheung Declaration is irrelevant; it is evidence for all that it says. And what the declaration says is that the prior art itself fails to teach the person of ordinary skill in the art how to make and use the claimed invention. That statement is highly relevant to the enablement determination, because, without any teaching in the prior art of how to make and use the invention, any such disclosure must come from the Specification.

We are not persuaded, however, that the Examiner was correct in determining that the disclosure in the Specification was insufficient. Appellant argues that a separate declaration of Cheung provides evidence that proves that the disclosure in the Specification is sufficient to enable a person of ordinary skill in the art to make and use the claimed invention. Appeal Br. 6–9 (citing Fifth Cheung Declaration (Sept. 23, 2013) ¶ 8). In relevant part, that declaration says that, when combined with prior-art knowledge, “the specification of the Cohen Application provides sufficient guidance and direction to enable a person of ordinary skill in the art . . . to deposit a CVD seed layer that is continuous on the sidewalls and bottom of

openings, and has a thickness between 50–400Å over the field, without undue experimentation.” Fifth Cheung Declaration (Sept. 23, 2013) ¶ 8. This is opinion testimony about an ultimate legal conclusion, namely enablement. Accordingly, it is entitled to no weight. *In re Chilowsky*, 306 F.2d 908, 916 (CCPA 1962) (expert opinions that application met the requirements of 35 U.S.C. § 112 were “incompetent expressions” not entitled to any weight).

The facts underlying the opinion expressed in the Cheung declaration, however, are entitled to some weight. *Id.* The Examiner found that, without some disclosure of the values to be given to the deposition variables, such as “pressure, substrate bias, sputtering gas pressure, sputtering gas flow rate, cathodic power, and plasma power density,” undue experimentation would be required in order to make and use the claimed invention. Final Act. 7–8. But Appellant argues that, on reading the Specification, a person of ordinary skill in the art “would understand that, by using inorganic precursors which do not contain carbon or oxygen atoms, the deleterious oxide or carbide intermediate layer can be avoided, and a continuous CVD seed layer having a thickness between 50-400Å (or between 50-250Å) over the field can be obtained.” Appeal Br. 12. Appellant directs us to some evidence of record supporting this argument. Fifth Cheung Declaration (Sept. 23, 2013) ¶ 8 (“The specification . . . teaches the POSITA that inorganic precursors (which do not include oxygen or carbon atoms) enable the deposition of a continuous CVD seed layer that has a thickness between 50-400Å over the field, or even between 50-100Å.”); *see* Spec. 16, ll. 5–28 (describing using “high purity, inorganic Cu compounds . . . which do not contain oxygen or carbon atoms” in place of metallo-organic compounds in order to achieve a

“clean metal-to-metal interface between a barrier layer containing a refractory metal and the depositing copper” and thereby to obtain “good adhesion, morphology, uniformity, and low electrical resistivity”). Further, Appellant explains that this use of inorganic precursors is an improvement on existing CVD seed layer techniques that result on their own in continuous and conformal CVD layers as thin as 300 angstroms. Spec. 5, ll. 22–26, 6, ll. 2–4. In light of this evidence, we are persuaded that the Examiner’s mere statement that no details about the CVD deposition process itself were provided was not sufficient to satisfy the burden on the Examiner in making a case of lack of enablement. *In re Wright*, 999 F.2d 1557, 1562 (Fed. Cir. 1993) (the Examiner must provide a reasonable explanation as to why the scope of protection provided by a claim is not adequately enabled by the disclosure); *In re Marzocchi*, 439 F.2d 220, 224 (CCPA 1971) (“[I]t is incumbent upon the Patent Office . . . to explain why it doubts the truth or accuracy of any statement in a supporting . . . presumptively accurate disclosure.”).

Accordingly, we reverse the rejection of claims 1–17 and 31–37 for lack of enablement.

Obviousness: Claims 1–3, 6–10, and 31–37

The Examiner rejected claims 1–3, 6–10, and 31–37 as obvious over the combination of Brown, Shacham-Diamand, and applicant-admitted prior art. Final Act. 11–13, 15–18. The Examiner found that Brown taught or suggested each limitation of these claims except for the first seed layer being deposited by CVD, the recited thickness of the first seed layer, and the first and second seed layers being deposited with different sets of deposition

parameters. *Id.* According to the Examiner, a person of ordinary skill in the art would have replaced Brown’s first PVD seed layer with the CVD seed layer of Shacham-Diamand because doing so would be more likely to result in a conformal seed layer. *Id.* at 13. Moreover, according to the Examiner, it would have involved only routine skill in the art to “discover[] the optimum or working ranges” of seed layer thickness. *Id.* at 12 (citing *In re Aller*, 220 F.2d 454 (CCPA 1955)). Finally, according to the Examiner, it was known in the art to vary deposition parameters, “such as duration of deposition.” *Id.* (citing disclosure at Spec. 18, ll. 17–24; Spec. 19, ll. 16–19; Spec. 20, ll. 1–14).

Appellant raises several arguments against these findings. First, Appellant argues that combining the teachings of Brown and Shacham-Diamand “would change the principle of operation of Brown . . . and would render it unsatisfactory for its intended purpose . . . because it would eliminate the unique improved flow and surface mobility of the PVD seed layer material.” Appeal Br. 21. Appellant does not direct us to any evidence of record to support this undeveloped argument. Accordingly, we are not persuaded by this argument. *In re Pearson*, 494 F.2d 1399, 1405 (CCPA 1974) (“argument in a brief cannot take the place of evidence”).

Second, Appellant argues that a person of ordinary skill in the art would not have replaced Brown’s first PVD seed layer with the CVD seed layer of Shacham-Diamand because doing so would impose disadvantages, including “poor adhesion to the barrier layer.” Appeal Br. 21–22, 29–30. Appellant does direct us to evidence that CVD layers do not adhere as well to barrier layers as do PVD layers. *Id.* at 29–30 (quoting Fifth Cheung Declaration (Sept. 23, 2013) ¶ 16(b)). Of course, this evidence is

contradicted by Appellant's argument, discussed above, that the mere disclosure of Appellant's barrier layer is sufficient to enable a person of ordinary skill in the art to make and use the claimed continuous CVD seed layer. Moreover, the evidence to which Appellant directs us provides a solution to the problem of poor CVD layer adhesion. According to Appellant's evidence, PVD "can readily deposit copper on the barrier layer 10 with relatively good adhesion," and a "preliminary PVD step is found to aid the nucleating of the later CVD copper film." Fifth Cheung Declaration (Sept. 23, 2013) ¶ 16(b) (emphasis removed). Thus, it was known in the art to deposit a PVD layer before a CVD layer to improve adhesion. Although Appellant's claims do not recite a limitation requiring the PVD step before the deposition of the CVD seed layer, they also do not exclude performing this preliminary step. Appeal Br. A1–A4. Accordingly, we are not persuaded by this argument that the Examiner committed reversible error in finding that it would have been obvious to combine the teachings of Brown and Shacham-Diamand by changing Brown's first PVD layer to Shacham-Diamand's CVD layer.

Third, Appellant argues that a person of ordinary skill in the art would not have used layers as thin as those claimed in the claims reciting thickness limitations, because Brown discloses that no continuous layer can be less than 1000 angstroms thick. Appeal Br. 22–23 (citing Brown, col. 4, ll. 29–34). But Brown does not make such a statement. Brown says that obtaining a thickness of at least 50 angstroms inside the opening (not obtaining a continuous layer) "tends" to lead to (not requires) a thickness of 1000 to 2000 angstroms in wide-open areas. Brown, col. 4, ll. 29–34. This does not constitute the "teaching away" that Appellant argues it does, because it

“does not criticize, discredit, or otherwise discourage” the use of thinner layers. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Instead, Brown merely teaches a disadvantage of using a thinner layer. Accordingly, we are not persuaded that Brown makes it so clear that thin layers were known to be discontinuous that the Examiner’s finding that the layer thickness was subject to optimization was erroneous.

Fourth, Appellant argues that Shacham-Diamand is not analogous art to the claimed invention. Appeal Br. 30–32. “The analogous-art test requires that the Board show that a reference is either in the field of the applicant’s endeavor or is reasonably pertinent to the problem with which the inventor was concerned in order to rely on that reference as a basis for rejection.” *In re Kahn*, 441 F.3d 977, 986–87 (Fed. Cir. 2006) (citing *In re Oetiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992)). Appellant argues that Shacham-Diamand is in the field of “electroless copper plating” rather than the invention’s field of “copper electroplating.” Appeal Br. 32 (emphasis removed). But a reference is analogous art, even if it is outside the field of the invention, if it “is reasonably pertinent to the problem with which the inventor was concerned.” *Kahn*, 441 F.3d at 987. Here, the problem with which the inventor was concerned was “produc[ing] a continuous seed layer on the sidewalls and bottom of . . . openings, while maintaining sufficient thickness on the field to facilitate void-free copper electrochemical filling of very narrow openings.” Spec. 6, ll. 7–10. We are persuaded that Schacham-Diamand, which relates to “form[ing] metal films as thin as 100 Å” with “low resistivity values approaching bulk values, low surface roughness, [and] excellent electrical and thickness uniformity,” is reasonably pertinent to that problem. Shacham-Diamand, Abstract.

Fifth, Appellant argues that the person of ordinary skill in the art would have had no reason to replace the PVD layer of Brown with the CVD layer of Shacham-Diamand to improve seed layer conformality, because Brown taught a process that, without any modification, already produced “good conformality.” Appeal Br. 32–34. As evidence, Appellant directs us to statements in Brown that assert that Brown’s process produces “improved step coverage and conformality” and that “the conformality . . . will have increased.” *Id.* (quoting Brown, col. 3, ll. 14–16, col. 4, ll. 64–65 (emphasis removed)). We do not find this argument persuasive. Brown’s statements merely assert that Brown improves on what was known in the art at the time of Brown, not that no further improvement on Brown’s process is possible. In addition, even if Brown did disclose that its process was somehow better than the process claimed by Appellant, this would not necessarily negate the suggestion to modify it by replacing it with the known more conformal CVD layer of Shacham-Diamand. *Fulton*, 391 F.3d at 1200–01 (reason to combine need not be supported by prior art suggestion that applicant’s solution is the preferred or most desirable alternative).

Finally, Appellant also argues that neither Brown nor Shacham-Diamand teaches a thin but continuous CVD layer. Appeal Br. 23. This ignores the Examiner’s findings that (1) the applicant-admitted prior art discloses that continuous CVD layers as thin as 300 angstroms were common in the prior art and (2) optimization of the thickness within the range of the prior art was a matter of routine skill in the art. Final Act. 7, 12; *see also* Spec. 5, ll. 23–26 (it was “common” in the prior art to use CVD to deposit layers with a “typical thickness of about 300Å to about 1,000Å”); Spec. 6, ll. 2–4 (the prior-art CVD deposition techniques “provid[ed]

continuous and complete step coverage of the seed layer”). Given these findings, we are not persuaded that the Examiner erred in concluding that it was within the routine skill in the art to achieve a continuous CVD seed layer with a thickness of 300 angstroms or higher. There are thus three types of claims: (1) those with no thickness limitations, (2) those with thickness limitations that overlap the prior-art range of 300 angstroms or higher, and (3) those with thickness limitations that do not overlap the prior-art range. For those claims in the first two categories, which are claims 1–3, 6, 7, 10, and 31–37, the fact that neither Brown nor Shacham-Diamand teaches a thin but continuous CVD layer is immaterial, because Appellant has not persuaded us that the Examiner erred by finding that a person of ordinary skill in the art would have been able to optimize the CVD seed layer thickness within the range that Appellant discloses was known in the prior art. For those claims in the third category, however, we are persuaded that the fact that neither Brown nor Shacham-Diamand teaches or suggests a thickness within the claimed range is important, because the Examiner has not provided sufficient evidence to support the finding that a person of ordinary skill in the art would have “optimized” the layer thickness in a way that resulted in layers thinner than those that Appellant has disclosed were well known. These claims include claims 8 and 9. Accordingly, we affirm the Examiner’s obviousness rejection of claims 1–3, 6, 7, 10, and 31–37, and we reverse the Examiner’s obviousness rejection of claims 8 and 9.

Obviousness: Claims 4 and 5

The Examiner rejected claims 4 and 5 as obvious over the combination of Brown, Shacham-Diamand, Liu, and applicant-admitted

prior art. Final Act. 14–15. With respect to claim 4, in addition to the findings discussed above, the Examiner found that Liu teaches or suggests “the first and second seed layers have no substantial overhangs sealing or pinching off at the top corners of the at least one opening.” *Id.* at 14 (citing Liu, col. 5, ll. 1–2). Appellant argues that it was improper for the Examiner to rely on the figures of Liu, Appeal Br. 42, but the Examiner did not rely on Liu’s figures, so we do not find this argument persuasive. In addition, Appellant argues that Liu cannot teach or suggest a lack of overhangs because “Liu . . . does not even mention overhangs.” *Id.* But Liu does disclose depositing “[a] thick copper layer,” “completely filling [the] dual damascene opening.” Liu, col. 4, l. 66–col. 5, l. 2. This “complete[] filling” could not be accomplished if there were overhangs pinching off the top of the opening, so Liu at least suggests avoiding the presence of such overhangs. Thus, we are not persuaded by this argument that the Examiner erred by rejecting claim 4 as obvious over the combination of Brown, Shacham-Diamand, Liu, and applicant-admitted prior art.

Appellant also argues that an additional piece of evidence, Chen,⁹ teaches that a person of ordinary skill in the art would have known that seed layers of the thickness disclosed in Liu would have exhibited “substantial overhangs on relatively narrow openings.” Appeal Br. 42. But Appellant’s claim 4 is not limited to narrow openings, so it does not exclude wide openings that would be free of the problem Appellant says is described in Chen. *Id.* at A2. Thus, we are not persuaded by this argument that the Examiner erred in rejecting claim 4.

⁹ Chen, U.S. Patent No. 6,197,181 B1, issued Mar. 6, 2001.

With respect to claim 5, Appellant argues that no reference teaches or suggests the recited thickness limitation requiring the first seed layer to be between 50 and 100 angstroms thick. *Id.* at 48–49. As discussed above, we are persuaded that it was error for the Examiner to find that a person of ordinary skill in the art would have optimized the layer thickness beyond the limits of the thicknesses known in the prior art. Accordingly, we affirm the Examiner’s obviousness rejection of claim 4 and reverse the Examiner’s obviousness rejection of claim 5.

Obviousness: Claims 11, 12, and 15

The Examiner rejected claims 11, 12, and 15 as obvious over the combination of Brown, Shacham-Diamand, Gandikota, and applicant-admitted prior art. Final Act. 18–19, 21. Appellant argues that Gandikota is not valid prior art, because Appellant has antedated Gandikota. Appeal Br. 63–64. Appellant’s only argument for this contention is a bare reference, without pinpoint citations, to an affidavit of the inventor, which is 22 paragraphs long and covers 76 pages. *Id.* Our rules require that an Appeal Brief include “arguments” that “shall explain why the examiner erred.” 37 C.F.R. § 41.37(c)(1)(iv). “[M]ere statements of disagreement . . . do not amount to a developed argument.” *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1320 (Fed. Cir. 2006). Accordingly, Appellant’s bare reference to a voluminous declaration is not an argument under our rules, and, therefore, it does not persuade us of any reversible error by the Examiner in failing to find that Appellant antedated Gandikota.¹⁰

¹⁰ The same is true of Appellant’s argument for antedating Hoinkis, Appeal

Appellant also argues that Gandikota “teaches away from” the subject matter of claims 11, 12, and 15. Appeal Br. 64–65, 80–81. We are not persuaded by this argument. Gandikota’s teaching that a CVD layer should have a PVD layer underneath it at most disparages placing a CVD layer directly on a barrier layer.¹¹ But claims 11, 12, and 15 do not require a CVD seed layer placed directly on a barrier layer; instead they require a CVD layer with at least two more layers placed on top of the CVD layer. *Id.* at A3. The claims do not exclude the presence of an additional PVD layer. *Id.* Accordingly, Gandikota does not teach away from claims 11, 12, and 15.

Finally, Appellant argues that no reference teaches or suggests the limitation of claims 11, 12, and 15 that requires the presence of a third seed layer on top of the first two seed layers. *Id.* at 67. The Examiner relied on Gandikota to teach or suggest a third layer. Final Act. 19 (citing Gandikota, col. 7). But Gandikota teaches a seed layer, an adhesion layer, and a barrier layer. Gandikota, col. 6, ll. 63–64, col. 7, ll. 31–35, Fig. 4. Although both the seed layer and the adhesion layer arguably could be considered seed layers, the Examiner does not explain why the barrier layer is also a seed layer. Final Act. 19. Accordingly, we reverse the rejection of claims 11, 12, and 15.

Br. 69, which relies on the same evidence in the same way.

¹¹ This assumes that Gandikota actually disparages anything. It is not clear that Gandikota actually does so. The portions of Gandikota to which Appellant directs us simply teach a disadvantage of CVD copper layers and express a preference for PVD layers. Gandikota, col. 2, ll. 53–57 (“CVD copper has less than desirable adhesion to the barrier layers and has a tendency to delaminate from the sidewalls”), col. 3, ll. 10–19 (“Preferably, the adhesion layer comprises copper . . . deposited by physical vapor deposition.”).

Obviousness: Claims 13, 16, and 17

The Examiner rejected claims 13, 16, and 17 as obvious over the combination of Brown, Shacham-Diamand, Hoinkis, and applicant-admitted prior art. Final Act. 19–20. We reverse the rejection of claim 13 for the same reasons we reverse the rejections of claims 11, 12, and 15, discussed above, because claim 13 also requires a third seed layer. Appeal Br. A3.

Claim 16 requires the presence of a first seed layer having a thickness between 50 and 200 angstroms. *Id.* We reverse the rejection of claim 16 for the same reasons we reverse the rejections of claims 5, 8, and 9, all of which require a thickness less than the range of thicknesses that the evidence of record shows was known in the art.

With respect to claim 17, Appellant argues first that Hoinkis “teaches away from” the subject matter of claim 17. *Id.* at 69–70 (emphasis removed). As with the argument that Gandikota teaches away, we are not persuaded by this argument. Hoinkis teaches the usefulness of depositing a first copper layer using PVD before depositing a CVD layer, but it does not disparage depositing the copper layer first. Hoinkis, col. 2, ll. 24–31 (teaching that the CVD “is *preferably* preceded by flash deposition of copper in particular, by a sputtering or physical vapor deposition,” which “is found to aid the nucleating of the later CVD copper film” (emphasis added)). Moreover, claim 17 does not exclude depositing a PVD layer before the CVD layer, as long as another seed layer is present above the CVD layer. Appeal Br. A3.

Appellant also argues that

neither Brown et al. (disclosing two PVD seed layers), nor AAPA (disclosing a single PVD or CVD seed layer), nor

Shacham-Diamand (disclosing a single PVD or CVD seed layer), nor Hoinkis (disclosing a PVD seed layer followed by a CVD seed layer), nor any combination thereof, discloses or suggests the deposition sequence of claim 17.

Id. at 74. This argument is not persuasive. First, to the extent that this is intended to argue that no single reference teaches or suggests the limitations of claim 17, we note that one cannot show nonobviousness by attacking references individually when the rejection is based on a combination of references. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). To the extent that this is intended to argue that the combination of the references does not teach or suggest the limitations of claim 17, we note that “mere statements of disagreement . . . do not amount to a developed argument.” *SmithKline Beecham*, 439 F.3d at 1320. Accordingly, we affirm the Examiner’s obviousness rejection of claim 17.

Obviousness: Claim 14

The Examiner rejected claim 14 as obvious over the combination of Brown, Shacham-Diamand, Hoinkis, Gandikota, and applicant-admitted prior art. Claim 14 depends from claim 13. Appeal Br. A3. Appellant argues that, like claim 13, claim 14 requires the presence of a third seed layer. *Id.* at 77–78. We agree, and we reverse the rejection of claim 14 for the same reasons that we reverse the rejection of claim 13.

DECISION/ORDER

The Examiner’s rejection of claims 1–17 and 31–37 under 35 U.S.C. § 112 as lacking sufficient enablement is reversed. The Examiner’s rejections of the following claims under 35 U.S.C. § 103(a) also are

reversed: (1) claims 8 and 9 as obvious over the combination of Brown, Shacham-Diamand, and applicant-admitted prior art; (2) claim 5 as obvious over the combination of Brown, Shacham-Diamand, Liu, and applicant-admitted prior art; (3) claims 11, 12, and 15 as obvious over the combination of Brown, Shacham-Diamand, Gandikota, and applicant-admitted prior art; (4) claims 13 and 16 as obvious over the combination of Brown, Shacham-Diamand, Hoinkis, and applicant-admitted prior art; and (5) claim 14 as obvious over the combination of Brown, Shacham-Diamand, Hoinkis, Gandikota, and applicant-admitted prior art.

The Examiner's rejections of the following claims under 35 U.S.C. § 103(a) are affirmed: (1) claims 1–3, 6, 7, 10, and 31–37 as obvious over the combination of Brown, Shacham-Diamand, and applicant-admitted prior art; (2) claim 4 as obvious over the combination of Brown, Shacham-Diamand, Liu, and applicant-admitted prior art; and (3) claim 17 as obvious over the combination of Brown, Shacham-Diamand, Hoinkis, and applicant-admitted prior art.

Thus, claims 8, 9, and 11–16 are not the subjects of any affirmed rejection. Claims 1–7, 10, 17, and 31–37 remain subject to at least one affirmed rejection.

It is ordered that the Examiner's decision is affirmed in part.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136.

AFFIRMED-IN-PART