

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CHONGQING YANMEI TECHNOLOGY CO., LTD.,
Petitioner,

v.

TERVES, LLC,
Patent Owner.

IPR2023-00521
Patent 10,689,740 B2

Before JO-ANNE M. KOKOSKI, JON B. TORNQUIST, and
JANE E. INGLESE, *Administrative Patent Judges*.

TORNQUIST, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. *Background and Summary*

Chongqing Yanmei Technology Co., Ltd. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 1–81 of U.S. Patent No. 10,689,740 B2 (Ex. 1001, “the ’740 patent”). Terves, LLC (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 7 (“Prelim. Resp.”).

On June 2, 2023, Patent Owner disclaimed claims 1–18 and 62 of the ’740 patent. Ex. 2008; Ex. 2009. Thus, only claims 19–61 and 63–81 remain in this proceeding. Prelim. Resp. 10; 37 C.F.R. § 42.107(e) (“No *inter partes* review will be instituted based on disclaimed claims.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2022). The standard for institution is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted “unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons set forth below, we determine that Petitioner demonstrates a reasonable likelihood of prevailing with respect to at least one claim of the ’740 patent. Accordingly, we grant institution of an *inter partes* review.

B. *Real Parties in Interest*

Petitioner identifies itself as the real party in interest and notes that Mr. Huang Guangsheng is its largest shareholder and legal representative. Pet. 1.

Patent Owner identifies itself as the real party in interest. Paper 3, 2.

C. Related Matters

The parties identify the following proceedings as related matters:

(1) *Terves LLC vs. Yueyang Aerospace New Materials Co. Ltd, et al.*, No. 1:19-cv-1611 (N.D. Ohio); (2) *Terves LLC vs. Yueyang Aerospace New Materials, Co, Ltd, et al.*, No. 2022-1855, 2022-2151 (Fed. Cir.); and (3) *Terves LLC v. Magnesium Machine, LLC*, No. 5:23-cv-00133 (W.D. Okla.). Paper 3, 2; Pet. 2–3.

D. The '740 Patent

The '740 patent is titled “Galvanically-Active in Situ Formed Particles for Controlled Rate Dissolving Tools” and discloses a magnesium composite for use as a dissolvable component in oil drilling. Ex. 1001, code (54), 1:16–17. The magnesium composite, in the form of a ball or other structure, may be seated in a hydraulic operation and subsequently “dissolved away” so that “no drilling or removal of the structure is necessary.” *Id.* at 1:19–24.

The '740 patent explains that “[g]enerally, the magnesium composite includes over 50 wt. % magnesium and less than about 99.5 wt. % magnesium and all values and ranges therebetween.” *Id.* at 31:54–58. To this magnesium composite is added one or more additives, which are selected and used in quantities “so that galvanically-active intermetallic or insoluble precipitates form in the magnesium or magnesium alloy while the magnesium or magnesium alloy is in a molten state and/or during the cooling of the melt.” *Id.* at 31:58–65. The “formation of particles in the melt is called in situ particle formation” and “can be used to achieve a specific galvanic corrosion rate in the entire magnesium composition and/or along the grain boundaries of the magnesium composite.” *Id.* at 32:17–22. The rate of corrosion may also be controlled through adjustment of the in

situ precipitate particle size, with smaller particles increasing the dissolution rate of the magnesium composite. *Id.* at 32:45–57.

In various embodiments, the magnesium composite may include over 50 wt. % magnesium and from 0.01-49.5 wt. % nickel, copper, or cobalt. *Id.* at 6:63–7:4, 7:23–32, 7:50–59. In addition to single additive compositions, the '740 patent contemplates using more than one additive, including one or more of nickel, copper, and cobalt. *Id.* at 2:56–58, 13:39–57.

E. Illustrative Claim

Petitioner challenges claims 19–61 and 63–81 of the '740 patent. Pet. 5–6. Claim 19, reproduced below, is illustrative of the challenged claims:

19. A dissolvable magnesium cast composite comprising a mixture of magnesium or a magnesium alloy and an additive material, said additive material includes one or more metals selected from the group consisting of a) copper wherein said copper constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite, b) nickel wherein said nickel constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite, and c) cobalt wherein said cobalt constitutes at least 0.01 wt. % of said dissolvable magnesium cast composite, said magnesium composite includes in situ precipitate, said in situ precipitate includes said additive material, a plurality of particles of said in situ precipitate having a size of no more than 50 μm , said magnesium composite has a dissolution rate of at least 5 $\text{mg}/\text{cm}^2/\text{hr}$. in 3 wt. % KCl water mixture at 90° C.

Ex. 1001, 40:14–28.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 19–61 and 63–81 of the '740 patent would have been unpatentable on the following grounds (Pet. 6):

Claim(s) Challenged¹	35 U.S.C. §²	Reference(s)/Basis
19–61, 63–81	102	Doud ³
19–61, 63–81	103	Xu ⁴ ,
1	102, 103	Xiao ⁵ or Xiao, Xu
19, 21, 29, 49–52, 58, 64, 76, 77	103	Xiao, Xu

In support of its grounds of unpatentability, Petitioner relies upon the declaration of Dr. Juan C. Nava. Ex. 1016.

II. ANALYSIS

A. Claim Construction

In this proceeding, the claims of the '740 patent are construed “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have had to a person of ordinary skill at the time of the invention, in the context of the

¹ Petitioner challenges claims 1–81 as anticipated by Doud and having been obvious over Xu. As Patent Owner has disclaimed claims 1–18 and 62, we do not consider those claims in the challenged grounds. In addition, we do not address Petitioner’s third ground based on Xiao or Xiao and Xu as it challenges only disclaimed claim 1. Finally, we do not address disclaimed claims 2–7, 10, 11, 13, 14, 16, and 18 in Petitioner’s fourth ground based on both Xiao and Xu. Pet. 6.

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103, effective March 16, 2013. Because each application in the priority chain of the '740 patent was filed after March 16, 2013, we apply the AIA versions of §§ 102 and 103. See 35 U.S.C. § 100(i)(1)(B).

³ US 2015/0299838 A1, published October 22, 2015. Ex. 1005 (“Doud”).

⁴ US 2013/0299185 A1, published November 14, 2013. Ex. 1007 (“Xu”).

⁵ CN 103343271 A, published October 9, 2013. Ex. 1006 (“Xiao”) (certified translation).

entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

With respect to claim 19, Petitioner proposes constructions for the terms “in situ precipitate” and “a plurality of particles of said in situ precipitate having a size of no more than 50 μm .” Pet. 11–12. With respect to claims 76–81, Petitioner proposes a construction for the term “wherein said additive material includes one or more metal materials selected from the group consisting of 0.1–35 wt. % copper, 0.1–24.5 wt. % nickel and 0.1–20 wt. % cobalt.” *Id.* at 13.

Patent Owner addresses only Petitioner’s claim construction argument with respect to claims 76–81. Prelim. Resp. 39–43.

Upon review of the arguments and evidence of record, we determine that no claim terms require express construction for purposes of this decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)). We do, however, address the scope of claims 76–81 in our discussion of the anticipation ground based on Doud.

B. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art “would have at least a Ph.D. in chemistry, metallurgy, or material science or material engineering” or, in the alternative, “would have a Bachelor of Science or Master of Science degree in one of these disciplines plus experience involving the use and design of dissolvable metal alloys for use in creating tools and other downhole parts for well drilling or completion activities.” Pet. 13–14.

Patent Owner does not address the proper level of ordinary skill in the art at this stage of the proceeding.

On this record, we adopt Petitioner’s unopposed definition as it is supported by the ’740 patent and the prior art of record. To the extent that any arguments rise or fall based on the proper level of ordinary skill in the art, however, the parties are encouraged to further address this issue during trial.

C. Priority Date of the ’740 Patent

The ’740 patent issued June 23, 2020, from application No. 16/158,915 (“the ’915 application”) filed October 12, 2018. Ex. 1001, codes (21), (22), (45). The ’740 patent indicates that the ’915 application is a continuation-in-part of application No. 15/641,439 (“parent application”), which issued as U.S. Patent No. 10,329,653, which is in turn a division of application No. 14/689,295 (“the ’295 application” or “grandparent application”), which issued as U.S. Patent No. 9,903,010. *Id.* at code (60).

Doud is the Patent Application Publication of the ’295 application and published October 22, 2015. Ex. 1005, codes (21), (43). Accordingly, to the extent that the ’740 patent is not entitled to the benefit of the filing date of the ’295 application,⁶ Doud is prior art to the ’740 patent and may be used in an anticipation or obviousness challenge.

⁶ Patent Owner represents that “the written specification for Doud (which issued as the ’010 patent) is substantively identical to the written specification for its divisional application that issued as the ’653 patent.” Prelim. Resp. 29–30.

1. *Legal Framework*

a) *Burdens of Proof and Production*

“It is elementary patent law that a patent application is entitled to the benefit of the filing date of an earlier filed application only if the disclosure of the earlier application provides support for the claims of the later application, as required by 35 U.S.C. § 112.” *In re Chu*, 66 F.3d 292, 297 (Fed. Cir. 1995). Patent Owner contends Petitioner “alone bears the burden of proof to demonstrate that each and every challenged claim is unpatentable, and that burden never shifts to the patentee.” Prelim. Resp. 38. According to Patent Owner, it is therefore Petitioner that must demonstrate that each challenged claim of the ’740 patent lacks written description support in the priority applications. *Id.* at 38–39 (“Petitioner did not identify a single instance where Doud does not support the dependent claims as written.”).

Although Petitioner always bears the ultimate burden of proof to show unpatentability of the challenged claims, during the course of trial there are shifting burdens of production. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Here, once Petitioner presents evidence that a reference is prior art under 35 U.S.C. § 102—by for example demonstrating that a reference has a publication date that is before the filing date of the involved patent—and that the reference anticipates one or more challenged claims, then the burden of production shifts to Patent Owner to present evidence sufficient to demonstrate that “the prior art does not actually anticipate” or that the reference “is not prior art because the asserted claim is entitled to the benefit of a filing date prior to the alleged prior art.” *Id.* at 1379 (quoting *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1327 (Fed. Cir. 2008)); *PowerOasis, Inc. v. T-Mobile USA, Inc.*,

522 F.3d 1299, 1305–1306 (Fed. Cir. 2008) (noting that it is the patent owner that must “come forward with evidence to prove entitlement to claim priority to an earlier filing date”); *see also In re NTP*, 654 F.3d 1268, 1276 (Fed. Cir. 2011) (noting that “a patent’s claims are not entitled to an earlier priority date merely because the patentee claims priority . . . Rather, for a patent’s claims to be entitled to an earlier priority date, the patentee must demonstrate that the claims meet the requirements of 35 U.S.C. § 120”).

b) Proving Written Description Support

One may demonstrate entitlement to an earlier priority date by showing that an earlier priority application provides written description support for the claims. *PowerOasis*, 522 F.3d at 1306. This written description requirement serves an important purpose “[i]n a patent system which allows claim amendments and continuation applications long after an initial application is filed,” it ensures “that the patent owner may only exclude others from what they had actually invented *as of the priority date.*” *Columbia Insurance Co. v. Simpson Strong-Tie Co., Inc.*, No. 2021-2145, 2023 WL 2733427, at *3 (Fed. Cir. Mar. 31, 2023) (non-precedential).

“To satisfy the written description requirement the disclosure of the prior application must ‘convey with reasonable clarity to those skilled in the art that, as of the filing date sought, the inventor was in possession of the invention.’” *PowerOasis*, 522 F.3d at 1306 (quoting *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991)) (internal marks omitted). One may show that it was in possession of the invention through “such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention.” *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997). “Although the exact terms need not be used *in haec verba*, . . . the specification must contain an equivalent

description of the claimed subject matter. A description which renders obvious the invention for which an earlier filing date is sought is not sufficient.” *Id.*

2. *Analysis*

a) *Claims 19–61 and 63–75*

Claim 19 of the ’740 patent requires one or more of copper, nickel, or cobalt in an amount of “at least 0.01 wt. %.” Ex. 1001, 40:16–23. Petitioner contends the requirement for “at least 0.01 wt.%” copper, nickel, or cobalt lacks written description support in the parent and grandparent applications of the ’740 patent. Pet. 22–23.

Absent some inherent limit set forth in the written description, the term “at least 0.01 wt. %” reads on embodiments containing 0.01–100 wt. % of the identified compound or element. *See MagSil Corp. v. Hitachi Global Storage Techs., Inc.*, 687 F.3d 1377, 1381 (Fed. Cir. 2012) (noting that the term “change in the resistance by at least 10%” covered changes in resistance from 10% up to infinity); *In re Wertheim*, 541 F.2d 257, 263 (CCPA 1976) (explaining that a range of “at least 35%” reads literally on embodiments employing content outside the 25–60% range disclosed in the priority application); *see also Indivior UK Ltd. v. Dr. Reddy’s Labs. S.A.*, 18 F.4th 1323, 1332 (Fed. Cir. 2021) (Linn, J., dissenting) (explaining that the ranges of “at least 25%” and “at least 50%” “are no different than if restated as ‘25%-100%’ and ‘50%-100%,’ respectively”). Patent Owner presents two arguments as to why one of ordinary skill in the art would understand that the inventors were in possession of a magnesium composite that contains “at least 0.01 wt. %” of copper, nickel, and/or cobalt.

First, Patent Owner contends that the law does not require “that an entire open-ended range” be supported in the written description. Prelim.

Resp. 33–34. And, because Petitioner concedes that one of ordinary skill in the art would understand that Doud’s specification supports amounts of additives up to 35 wt.%, Patent Owner asserts that Doud’s support of claim 19 “is as a matter of law.” *Id.* at 33.

This argument is not persuasive. Although “[i]t is not necessary that the application describe the claim limitations exactly,” the application must demonstrate to persons of ordinary skill in the art that the applicants invented a composition including those limitations. *Wertheim*, 541 F.2d at 262. On its face, the range of “at least 0.01 wt. %” encompasses a range that is broader than 0.01–35 wt. %, and Patent Owner does not sufficiently explain why a person of ordinary skill in the art would understand from merely a disclosure of 35 wt.% that the inventors were in possession of the entire claimed range for copper, cobalt, or nickel in the magnesium composition.

Second, Patent Owner contends that one of ordinary skill in the art would understand that “at least 0.01 wt. %” is not unbounded, but instead is limited to a range of 0.01 to 35 wt. %. Prelim. Resp. 34–37; *Wertheim*, 541 F.2d at 264 (explaining that an applicant may show that an upper limit is inherent in the range of “at least 35%”). Patent Owner reasons that the magnesium compositions of the invention each contain at least 50.1 wt. % magnesium, inherently setting an upper bound of 49.9% for additives. Prelim. Resp. 35. Recognizing that there is an inherent upper limit to the “at least 0.01 wt. %” limitation in the ’740 patent, Patent Owner contends one of ordinary skill in the art reviewing the disclosures of the parent and grandparent applications would understand that the upper end boundary of “at least .01 wt. %” in claim 19 is 35 wt. % for copper and nickel and 20 wt. % for cobalt. *Id.* at 36.

On this record, we agree with Petitioner and Patent Owner that one of ordinary skill in the art reviewing the priority disclosures of the parent and grandparent applications would understand that the upper boundary of copper and nickel in these applications is 35 wt. % and the upper boundary of cobalt is 20 wt. %. Prelim. Resp. 36 (citing Ex. 1016 ¶¶ 41–42); Pet. 22–24. That said, the '915 application modified the written description support for the upper boundaries of these additives, expanding the permissible levels of nickel, copper, and cobalt to 0.01–49.5 wt. %. Ex. 2019, 6–7; Ex. 1001, 6:65–7:4, 7:25–32, 7:52–59. Patent Owner does not persuasively explain why one of ordinary skill in the art presented with a range of 0.01–49.5 wt. % for nickel, copper, and cobalt in the written description of the '740 patent, would then conclude that the term “at least 0.01 wt. %” in claim 19 is in fact limited to 35 wt. %.

On this record, the term “at least 0.01 wt. %” in the '740 patent encompasses values for nickel, copper, and cobalt that are higher than the 35 wt. % (nickel and copper) and 20 wt. % (cobalt) limits outlined in the parent and grandparent applications. Accordingly, we determine that there is a reasonable likelihood that claim 19 of the '740 patent is not entitled to the benefit of the filing dates of its priority applications. Challenged claims 20–61 and 63–75 depend from claim 19 and there is no argument presented that these claims have independent written description support in Doud. For example, there is no evidence presented that any of these dependent claims narrow the ranges for each of copper, nickel, and cobalt recited in

independent claim 19 such that there is adequate written description support in the '295 application for these claims.⁷

Accordingly, for purposes of this Decision, we apply Doud as prior art to challenged claims 19–61 and 63–75.

b) Claims 76–81

Claims 76–81 depend, directly or indirectly, from independent claim 19, and further restrict the amount of copper, nickel, and cobalt in the cast composition. For example, claim 76 depends from independent claim 19 and further requires “wherein said additive material includes one or more metal materials selected from the group consisting of 0.1–35 wt. % copper, 0.1–24.5 wt. % nickel and 0.1–20 wt. % cobalt.” Ex. 1001, 44:18–22.

Petitioner does not make any specific lack of written description arguments with respect to dependent claims 76–81, apart from its arguments based on independent claim 19. *See* Pet. 22–24. Petitioner does contend, however, that claims 76–81 should not be construed to limit all of the ranges of copper, nickel, and cobalt recited in claim 19. *Id.* at 13. For example, Petitioner contends that if a magnesium composition includes copper at 1 wt. % and cobalt at 22 wt. % the composition would meet the claim as a whole, even though the level of cobalt is above the recited range. *Id.*

Patent Owner appears to agree with this portion of the analysis, stating that for infringement “only one limitation has to be satisfied in a Markush

⁷ Claims 20–61 and 63–75 all depend, directly or indirectly, from independent claim 19, and many of these claims vary the amount and types of additives used in the magnesium cast composite. Patent Owner is encouraged to address whether one or more of these dependent claims sufficiently limits the type or amount of additives used in the magnesium cast composite such that the '295 application provides sufficient written description support for such claims.

group.” Prelim. Resp. 42. Patent Owner further argues that the upper boundaries of 35 wt. %, 24.5 wt. %, and 20 wt. % for copper, nickel, and cobalt, respectively, are literally supported by Doud. *Id.* (citing Pet. 22–24; Ex. 1016 ¶¶ 41–42).

The use of the term “consisting of” in a Markush group “creates a strong presumption that that claim element is ‘closed’ and therefore ‘excludes any elements, steps, or ingredients not specified in the claim.’” *Multilayer Stretch Cling Film Holdings, Inc. v. Berry Plastics Corp.*, 831 F.3d 1350, 1358 (Fed. Cir. 2016) (quoting *AFG Indus., Inc. v. Cardinal IG Co., Inc.*, 239 F.3d 1239, 1245 (Fed. Cir. 2001)). Thus, if a patent claim recites “a member selected from the group consisting of A, B, and C” then the “member” is closed to alternative ingredients D, E, and F. *Id.*

Here, claim 76 recites that the “additive material” includes “one or more metal materials selected from the group *consisting of* 0.1–35 wt. % copper, 0.1–24.5 wt. % nickel and 0.1–20 wt. % cobalt.” Ex. 1001, 44:18–22 (emphasis added). Although the claim uses the broad term “includes,” the use of “consisting of” to limit the group from which the one or more metals are selected creates a strong presumption that the claim is closed to any other additive metal materials beyond those listed. *See Shire Development, LLC v. Watson Pharms, Inc.*, 848 F.3d 981, 985 (Fed. Cir. 2017) (noting that the term “consisting of” requires that the “invention contains only what is expressly set forth in the claim”); *Norian Corp. v. Stryker Corp.*, 363 F.3d 1321, 1331 (Fed. Cir. 2004) (noting that ordinarily the use of “consisting of” requires that no other elements may be present beyond those listed in the claim). As such, the use of 1 wt. % copper could fall within the scope of the claim, but we question whether the use of 1 wt. % copper in addition to an additive metal material that is not within the

Markush group, such as 22 wt. % cobalt, would fall within the claim. *See Shire*, 848 F.3d at 985 (noting that the presence of a compound that is not within the scope of a “consisting of” Markush group means the “limitation is literally violated”).

To the extent that Petitioner is aware of authority to support its position that the express limitations of a Markush group, such as a limit of 20 wt. % cobalt, can be violated so long as at least one member of the Markush group, such as 1 wt. % copper, is found in the composition, it is encouraged to present such authority during trial.

As there appears to be no dispute that Doud provides written description support for the recited levels of copper, nickel, and cobalt in claims 76–81, and the claims may not literally read on a composition having levels of copper, nickel, and cobalt that are outside the recited ranges, we determine that these claims are entitled to the benefit of the filing date of Doud. As such, we do not apply Doud as prior art to claims 76–81. *See Chu*, 66 F.3d at 297 (noting that the analysis of whether a patent may claim benefit to an earlier filed application is conducted on a claim-by-claim basis); *see also PowerOasis*, 522 F.3d at 1306 (explaining that different claims of a continuation-in-part application may receive different effective filing dates). We reiterate, however, that the proper construction of claims 76–81 is an open question that the parties are encouraged to further address during trial.

III. ANALYSIS

A. *Claims 19–61 and 63–81 as Anticipated by Doud*

1. *Claims 19–61 and 63–75*

As discussed above, Doud is the patent publication of the grandparent application of the '915 application, which ultimately issued as the '740

patent. As such, it contains many of the same disclosures and embodiments as the '740 patent. For example, Doud and the '740 patent both disclose a method of forming a novel magnesium composite that includes melting an AZ91D magnesium alloy containing 90 wt. % magnesium, 9 wt. % aluminum, and 1 wt. % zinc. Ex. 1005 ¶¶ 45, 47; Ex. 1001, 21:43–51, 22:48–53, 33:32–43, 34:9–12. To this alloy is added either 7 wt. % nickel or 10 wt. % copper. Ex. 1005 ¶¶ 45, 47, 53, 57; Ex. 1001, 21:48–51, 22:53–56, 33:35–36, 34:12–13. These additives are mixed in the magnesium alloy at a temperature that is less than the melting point of copper or nickel, and the casting is then cooled. Ex. 1005 ¶¶ 45, 47, 53, 57; Ex. 1001, 21:51–54, 22:56–58, 33:35, 34:12–13. Doud reports that nickel and copper, when added to molten magnesium, will form Mg_2Ni and $CuMg_2$ intermetallic, galvanically-active, in situ precipitates. Ex. 1005 ¶¶ 12–13. Doud discloses that the dissolution rate of the resulting casting material is either $325 \text{ mg/cm}^2\text{-hr}$ (nickel) or $50 \text{ mg/cm}^2\text{-hr}$ (copper) in a 3% KCl solution at 90° C . Ex. 1005 ¶¶ 45, 47, 53, 57; Ex. 1001, 21:60–62, 22:61–63, 33:41–43, 34:15–17. Doud also discloses that the average particle diameter of the additives used in the invention is generally “at least about 0.1 microns” and “typically no more than about 500 microns.” Ex. 1005 ¶ 6.

Petitioner explains how the identified disclosures of Doud anticipate independent claim 19. Pet. 39–40. Petitioner also identifies where the limitations of dependent claims 20–61 and 63–75 are disclosed in Doud. *Id.* at 41–45.

Patent Owner does not address Petitioner’s anticipation arguments with respect to claims 19–61 and 63–75, apart from arguing that Doud is not prior art to these claims. Prelim. Resp. 27–39.

Upon review of the evidence presented, we determine that Petitioner demonstrates a reasonable likelihood that claims 19–61 and 63–75 are anticipated by Doud.

2. *Claims 76–81*

Petitioner contends claims 76–81 are also anticipated by Doud. Pet. 45. For the reasons discussed above, on this preliminary record, we are not persuaded that Doud is prior art to claims 76–81. Accordingly, significant questions exist as to whether Doud anticipates claims 76–81 of the '740 patent.

B. *Claims 19–61 and 63–81 over Xu*

Petitioner contends that claims 19–61 and 63–81 would have been obvious over the disclosures of Xu. Pet. 46–60.

1. *Xu*

Xu is titled “Disintegrable Metal Cone, Process of Making, and Use of the Same.” Ex. 1007, code (54). The processes of making the metal cone, or “frustoconical member,” of Xu involves “combining a metal matrix powder, a disintegration agent, and metal nanomatrix material to form a composition,” “compacting the composition,” sintering the compacted composition, and pressing the sintered composition to form the desired member. *Id.* ¶ 3.

Xu explains that the metal composite includes a cellular nanomatrix comprising a nanomatrix material, and a metal matrix comprising a particle core material dispersed in the cellular nanomatrix. *Id.* ¶ 31. The particle core material comprises a nanostructured material and may include elements such as aluminum, iron, magnesium, manganese, and zinc, or combinations thereof. *Id.* ¶¶ 31–32. The disintegration agent may include a metal including copper, cobalt, and nickel. *Id.* ¶ 35.

Xu notes that additive particles may be added to provide a dispersion strengthening mechanism to the metal matrix and may take the form of “an embedded particle,” “a precipitate particle,” or “a dispersoid particle.” *Id.* ¶ 38. When in the form of “an embedded particle,” the additive may be one of various “hard particles,” including copper, nickel, cobalt, etc. *Id.* These additive particles “can have an average particle size of about 10 nm to about 1 micron, and specifically about 50 nm to about 200 nm.” *Id.*

Xu notes that compacted powder metal composites “can be configured to provide a wide range of selectable and controllable corrosion or disintegration behavior from very low corrosion rates to extremely high corrosion rates,” particularly when compared to “powder compacts that do not incorporate the cellular nanomatrix.” *Id.* ¶ 59. Xu also asserts that “metal alloys (formed by, e.g., casting from a melt or formed by metallurgically processing a powder) without the cellular nanomatrix also do not have the selectively tailorable material and chemical properties as the metal composites herein.” *Id.*

2. *The Parties’ Arguments*

Petitioner’s analysis of Xu consists primarily of a claim chart identifying where Petitioner contends the limitations of claim 19 are disclosed in Xu. Pet. 55–56. Of particular note, Petitioner contends that paragraph 59 of Xu discloses a “cast material,” and paragraph 38 of Xu discloses additives of copper, nickel, and cobalt that form a precipitate in situ. *Id.* at 55.

With respect to the claimed dissolution rates, Petitioner contends that Xu discloses dissolution in KCl brines at temperatures up to about 800°, 1000°, or 1200° F (427°, 537°, or 649° C) at a rate of 50–500 mg/cm²-hr. Pet. 55–56 (citing Ex. 1007 ¶¶ 52, 54). According to Petitioner, “[b]ecause

the disclosed ranges overlap and/or embrace the range and/or values in the '740 patent,” a person of ordinary skill in the art would consider them obvious as overlapping ranges or through routine optimization. *Id.* at 56.

Patent Owner contends this ground fails because Xu does not disclose a magnesium cast composite, but rather a compacted and sintered powder composite. Prelim. Resp. 45. Patent Owner also contends that the additive particles disclosed in paragraph 38 of Xu are “not remotely comparable with the in situ particles” recited in claim 19. *Id.* at 46. Patent Owner also contends that Xu discloses temperatures that are much higher than 90° C and a broad dissolution rate range that is completely dependent on the composite, the dissolving agent used, and the temperature. *Id.* at 49–50. Finally, Patent Owner contends that one of ordinary skill in the art would not find Xu relevant because Xu itself states that composite formulations without a cellular matrix, such as those formed by casting from a melt or metallurgically processing a powder, “do not have the selectively tailorable material and chemical properties as the metal composites herein.”⁸ *Id.* at 45–46.

3. *Analysis*

The invention recited in the '740 patent is to a “magnesium cast composite” containing in situ precipitates of copper, nickel, and/or cobalt. Ex. 1001, 40:14–28. The requirement for a “magnesium cast composite” is

⁸ Patent Owner also asserts that paragraph 39 of Xu is directed to magnesium particles and allows a vast range of particle sizes. Prelim. Resp. 46–47. Petitioner does not cite to paragraph 39 as support for its ground based on Xu, but we note that we address this general argument below with respect to obviousness over Xiao and Xu.

found in both the preamble and body of claim 19 and neither party disputes that the term “magnesium cast composite” is limiting. *Id.*

Petitioner’s only support for a disclosure of “a magnesium cast composite” in this ground is its citation to paragraph 59 of Xu. Pet. 55. Paragraph 59, however, appears to specifically distinguish Xu’s compacted powder compositions from metal alloys that are formed by casting from a melt. Ex. 1007 ¶ 59. Thus, on this record, Patent Owner appears to have a strong argument that Xu does not in fact teach or suggest a “cast composite” containing the constituents recited in claim 19. Prelim. Resp. 44–45.

Patent Owner also raises a significant question as to whether one of ordinary skill in the art looking to form a magnesium cast composite would look to the disclosures of Xu, which specifically differentiates the properties of its compacted powder products from cast magnesium composites that lack a nanomatrix. Ex. 1007 ¶ 59; Prelim. Resp. 45–46.

With respect to dissolution rates, Patent Owner raises a significant question as to whether one of ordinary skill in the art would have understood from the various broad ranges disclosed in Xu that any particular composite of Xu could achieve the claimed dissolution rate in 3 wt. % KCl brine at 90° C.

On the issue of in situ particle size, Patent Owner provides no evidence to support its attorney argument that the sizes of the additive particles of Xu are “not remotely comparable with the in situ particles” of claim 19. Prelim. Resp. 46. As such, this argument is not particularly persuasive.

In view of the foregoing, we question whether Petitioner has demonstrated a reasonable likelihood that claims 19–61 and 63–81 would have been obvious over Xu.

C. Claims 19, 21, 29, 49–52, 58, 64, 76, and 77 over Xiao and Xu

Petitioner contends that the subject matter of claims 19, 21, 29, 49–52, 58, 64, 76, and 77 would have been obvious over the combined disclosures of Xiao and Xu. Pet. 65–74.

1. Xiao

Xiao discloses a “light and pressure-proof fast-decomposed cast magnesium alloy” that can be used “as a tripping ball material for a multi-stage sliding sleeve staged-fracturing technique.” Ex. 1006, code (57). The cast magnesium alloy “is composed of the following components: 13 to 25% of Al, 2 to 15% of Zn, 0.1 to 5% of Fe, 0.05 to 5% of Cu, 0.05 to 5% of Ni, 0 to 5% Ag, 0.05 to 0.5% Zr, 0.05 to 0.5% of Ti, and the remainder is Mg.” *Id.*

In the cast magnesium alloy of Xiao, a high content of aluminum is used “to produce a large amount of cathode phase, the β ($\text{Mg}_{17}\text{Al}_{12}$) phase and eutectic phase on the grain boundary of the magnesium alloy,” with the magnesium matrix α phase functioning as an anode phase such that the matrix and the grain boundary of the magnesium alloy “form a large amount of micro-batteries, which greatly accelerate the corrosion decomposition of magnesium alloy.” *Id.* ¶ 26. Xiao further explains that “[e]lements such as Fe, Cu, Ni, Ag, etc., in the magnesium alloy can form a large number of intermetallic composite micro-particles, which can improve corrosion performance of the magnesium alloy.” *Id.*

2. The Parties’ Arguments

Petitioner contends that paragraph 26 of Xiao discloses “microparticles” of the claimed additives and that these “microparticles” generally have a size range of 100 nm to 1000 μm , but Petitioner concedes that Xiao “does not disclose the plurality of particles of the in situ precipitate

have a size of no more than 50 μm .” Pet. 66–67. Petitioner asserts, however, that one of ordinary skill in the art would have restricted the size of the microparticles to no more than 50 μm in view of Xu’s teaching that additive particles within this size range “provide for strengthening of the metal composite.” *Id.* at 67 (citing Ex. 1007 ¶ 38).

Patent Owner contends Xu teaches away from a cast composite and “[t]here is no dispute that every word in Xiao has been closely – and repeatedly – examined by both the USPTO Examiner and Reexamination Unit,” with all coming to “the same conclusion: Xiao does not teach in situ precipitates formed from copper, nickel, and/or cobalt.” Prelim. Resp 17, 50–51.

Patent Owner also contends that Xiao’s use of $\text{Mg}_{17}\text{Al}_{12}$ –Mg micro-batteries teaches away from the claims, which require “galvanically-active in situ precipitates formed between the magnesium alloy and the additive material, newly formed galvanically-active intermetallic particles incorporating secondary metal, or un-melted remnants of elementary secondary metal additives.” *Id.* at 52 (citing Ex. 2018 ¶ 37).

Patent Owner further contends that Xu discloses “an incredibly broad range of sizes for the metal matrix, i.e., the magnesium, ranging from as small as 50 nm all the way up to 800 μm .” *Id.* at 53 (citing Ex. 1007 ¶¶ 38–39). According to Patent Owner, this broad range does not teach the size range of claim 19 because most of the range would include particles that are much larger than 50 μm , “which is the opposite of what claim 19 requires,” and Xu provides no teaching of what ranges provide any desirable functions. *Id.*

3. *Analysis*

Contrary to Patent Owner's argument, we discern no requirement in claim 19 that the additive material form "galvanically-active intermetallic particles," or that the additive material be composed of "elementary secondary metal additives." Prelim. Resp. 52; Ex. 1001, 3:64–4:3 (explaining that the "one or more additives" may be "in the form of an alloy or a pure or substantially pure additive element"). Patent Owner's support for this proposition is merely a citation to a declaration addressing independent claim 1 at issue in the reexamination proceeding, which, in contrast to claim 19 of the '740 patent, expressly requires "in situ precipitation of galvanically-active intermetallic phases to enable controlled dissolution of said magnesium composite." Ex. 2018 ¶ 37 (declaration of Lee A. Sanger, Ph.D.); Ex. 1008, 21.

As noted by both parties, Xiao was at issue during reexamination of related patent 10,329,653, and its disclosures were the subject of extensive briefing. In that proceeding, the requester asserted that Xiao discloses the use of copper, nickel, iron, and cobalt as an additive and that such additives are shown to form microparticles, i.e., an in situ precipitate. Ex. 1008, 27. In allowing the claims the Examiner stated:

The following is an examiner's statement of reasons for patentability and/or confirmation of the claims found patentable in this reexamination proceeding: Xiao is the closest prior art and it fails to teach a magnesium alloy that include in situ galvanically-active intermetallic phases or intermetallic particles to enable controlled dissolution of the magnesium alloy as claimed. The phases of Xiao taught to be involved in galvanic activity contain aluminum instead of the secondary/additive material required by the claims. There is no suggestion from Xiao to substitute copper, nickel, iron, or cobalt for the aluminum in the galvanically-active intermetallic.

Ex. 1009, 4.

Contrary to Patent Owner's arguments, we discern no assertion or conclusion in the Examiner's reasons for allowance suggesting that no in situ precipitates are formed from copper, nickel, and/or cobalt in Xiao. Prelim. Resp. 17. The Examiner's reasons for allowance appear to be focused instead on whether copper, nickel, or cobalt are used in Xiao to form a galvanically-active intermetallic that enables controlled dissolution of the magnesium alloy—a requirement not found in independent claim 19 of the '740 patent.

With respect to the “in situ particle” limitation of claim 19, Xiao discloses using copper and nickel in the magnesium composition to form “intermetallic composite micro-particles.” Ex. 1006 ¶ 26. On this record, this is sufficient to teach or suggest in situ precipitants. Ex. 1001, 4:20–13 (“The never melted additive(s) and/or the newly formed alloys that include one or more additives are referred to as in situ particle formation in the molten magnesium composite.”).

Also contrary to Patent Owner's argument, in citing to paragraph 38 of Xu, Petitioner relies not upon Xu's disclosure of magnesium particle sizes, but its disclosure of “additive particle” sizes. Pet. 72–73. Xu provides a preferred size range of 50–200 nm for these additive particles, a range that is fully encompassed by the claimed range, and explains that these additive particles are disposed within the cellular nanomatrix for the purpose of strengthening the metal composite. Ex. 1007 ¶ 38.

Ultimately, however, we agree with Patent Owner that there is a significant question as to why one of ordinary skill in the art seeking to form a magnesium cast composite would have looked to particle

sizes in a reference directed to sintered magnesium powder composites. Prelim. Resp. 54. This is especially pertinent because Xu appears to disclose that metal alloys formed by casting from a melt “do not have the selectively tailorable material and chemical properties” of the disclosed powder-based composites.⁹ Ex. 1007 ¶ 59.

In view of the foregoing, we question whether Petitioner has demonstrated a reasonable likelihood of demonstrating that claims 19, 21, 29, 49–52, 58, 64, 76, and 77 would have been obvious over the combined disclosures of Xiao and Xu.

IV. DISCRETIONARY DENIAL

Patent Owner contends we should exercise our discretion to deny the Petition under 35 U.S.C. § 325(d), as well as under 35 U.S.C. § 314(a) and § 316(b). Prelim. Resp. 12–27.

A. *Discretionary Denial Pursuant to 35 U.S.C. § 325(d)*

Patent Owner contends that we should exercise our discretion under 35 U.S.C. § 325(d) to deny the Petition, applying our precedential decisions in *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020) (precedential) (“*Advanced Bionics*”), and *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017) (precedential as to § III.C.5,

⁹ In its arguments with respect to independent claim 19 and dependent claims 21, 29, 49–52, 58, 64, 76, and 77, Petitioner provides a single citation to paragraphs 67–80 of Dr. Nava’s declaration. Pet. 68. These paragraphs are not explained in the Petition and, therefore, they provide limited support for the conclusions reached in the Petition. See 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”).

first paragraph) (“*Becton, Dickinson*”). Prelim. Resp. 12–19. For the reasons provided below, we decline to exercise our discretion to deny institution under § 325(d).

1. Applicable Framework

Section 325(d) provides that, in determining whether to institute an *inter partes* review, “the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. § 325(d). The Board uses a two-part framework in determining whether to exercise its discretion under § 325(d), specifically we determine:

- (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and
- (2) if either condition of the first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, Paper 6 at 8.

In applying the two-part framework, we consider several non-exclusive factors identified in *Becton, Dickinson*, which provide “useful insight into how to apply the framework” (*Advanced Bionics*, Paper 6 at 9):

- (a) the similarities and material differences between the asserted art and the prior art involved during examination;
- (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
- (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;

(d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;

(e) whether Petitioner has pointed out sufficiently how the examiner erred in its evaluation of the asserted prior art; and

(f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments. *Becton, Dickinson*, Paper 8 at 17–18.

If, after review of factors (a), (b), and (d), we determine that the same or substantially the same art or arguments previously were presented to the Office, we then review factors (c), (e), and (f), to determine whether the Office erred in a manner material to the patentability of the challenged claims. *Advanced Bionics*, Paper 6 at 10.

2. *Analysis*

a) *Factors (a), (b), (d)*

Petitioner relies on grounds based on one or more of Doud, Xu, and Xiao. Pet. 6. Doud, Xu, and Xiao were either listed on an IDS during prosecution of the '740 patent or appear on the face of the '740 patent as cited art. Ex. 1001, code (56) (Xu issued as US Patent No. 9,016,384 B2, which is listed on the face of the '740 patent); Ex. 2023, 6 (identifying Doud), 8 (identifying Xiao (CN 103343271)).

Despite the fact that the three references appear either on an IDS or the face of the '740 patent, Petitioner contends the Petition does not present “the same or substantially the same prior art or arguments previously” presented to the Office because the claims of the '740 patent have different limitations as those considered during reexamination of the '653 application. Pet. 79. This argument is not persuasive because Doud and Xiao were listed

on an IDS *during prosecution of the '740 patent* and Xu is identified on the face of the '740 patent as a cited reference.¹⁰ On this record, this is sufficient to show that these prior art references were previously presented to the Office. *Advanced Bionics*, Paper 6 at 7–8.

As each cited reference was before the Examiner during prosecution of the '740 patent and/or was made of record on the face of the '740 patent, we conclude that the same or substantially the same art or arguments previously were presented to the Office. Thus, we must consider whether Petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims.

b) Factors (c), (e), and (f)

With respect to factor (c), the Examiner's Reasons for Allowance does not mention Doud, Xu, or Xiao, and there is no other record evidence that indicates what, if any, focus was given to those references by the Examiner during prosecution, let alone whether the references were the basis of any rejection. Ex. 1015, 6–7. As a result, on the present record we cannot determine the extent to which these prior art references were evaluated during examination. Moreover, we agree with Petitioner that the claims of the '740 patent are materially different from those considered during the reexamination proceeding. Accordingly, factor (c) is, at best, neutral, and does not support exercising our discretion to deny the Petition.

With respect to factor (e), for the reasons discussed above, we determine that Doud is prior art to claims 19–61 and 63–75 of the

¹⁰ Patent Owner contends the fact that Xu appears as a cited reference on the face of the '740 patent indicates that it was included on an IDS. Prelim. Resp. 16. Petitioner does not appear to contest that Xu was considered by the Examiner during prosecution of the '740 patent. Pet. 79.

'740 patent and that Petitioner has demonstrated a reasonable likelihood that these claims are anticipated by Doud. Thus, the Office committed a material error by not considering Doud with respect to claims 19–61 and 63–75.

Factor (e), therefore, counsels strongly against exercising our discretion to deny the Petition.

With respect to factor (f), as discussed above, Petitioner presents evidence that Doud does not provide written description support for claims 19–61 and 63–75 of the '740 patent. This evidence does not appear to have been previously considered by the Office. *See PowerOasis*, 522 F.3d 1299, 1305 (Fed. Cir. 2008) (noting that “[i]n the absence of an interference or rejection which would require the PTO to make a determination of priority, the PTO does not make such findings as a matter of course during prosecution”). Thus, factor (f) counsels against exercising our discretion to deny the Petition.

c) Conclusion

Because Petitioner demonstrates a reasonable likelihood that (1) Doud anticipates claims 19–61 and 63–75, and (2) Doud is prior art to at least one claim of the '740 patent, we determine that Petitioner demonstrates that the Office erred in a manner material to the patentability of the challenged claims. Accordingly, we decline to exercise discretion to deny the Petition pursuant to 35 U.S.C. § 325(d).

B. Discretionary Denial under 35 U.S.C. § 314(a) and § 316(b) in view of the Mineral National Emergency

Patent Owner asserts that a “National Emergency” was declared by Executive Order 13953 (Ex. 2004), in which President Donald Trump directed every federal agency to “prioritize” the “protection of the domestic supply chain” for critical minerals, including magnesium. Prelim. Resp. 20.

Patent Owner asserts that it is the only American company manufacturing the patented cast magnesium composites and it built the only secondary magnesium processing plant in the U.S. in the past 50 years. *Id.* Granting this Petition, Patent Owner asserts, “would threaten (not protect) the domestic supply chain in processed magnesium used in the oil/gas industry” and would deplete Patent Owner’s “crucial funds, resources, time and attention,” that should instead be devoted “to expanding its plant and marketplace footprint, to help our nation address the National Emergency.” *Id.* at 21.

Patent Owner presents a declaration from Professor Mark Cohen, who opines that numerous interlocking factors suggest that the Petition is part of a broader campaign by the Chinese government to harass and drain resources of a domestic company and enhance its own magnesium processing capacity. Prelim. Resp. 22–23 (citing Ex. 2001 ¶¶ 3, 38–50). Professor Cohen opines that an “Article III US court” would be better positioned to address these issues in view of its greater capacity to compel production of foreign evidence and impose penalties for non-compliance with any discovery requests. Ex. 2001 ¶¶ 9, 49.

Given the threats to domestic production of magnesium, the potential involvement by a foreign country, and the fact that Petitioner has no known commercial presence in the magnesium manufacturing field, Patent Owner asserts that the Board should discretionarily deny the Petition and avoid wading into “delicate matters of foreign and economic policy.” Prelim. Resp. 20–21, 25 (citing Ex. 2001 ¶¶ 70–72); *see id.* at 26–27 (asserting that “instituting trial would violate EO13953, or at least make the Board appear to be the cat’s paw of a foreign sovereign against the interests of a protected domestic industry”).

Patent Owner cites to no case in which a Director, past or present, has invoked Executive Order 13953 (or any related Orders) to discretionarily deny institution of an *inter partes* review. As such, we decline to exercise discretion to deny the Petition.¹¹

V. CONCLUSION

For the reasons discussed above, Petitioner demonstrates a reasonable likelihood that it would prevail in showing that at least one claim of the '740 patent is unpatentable.

VI. ORDER

Accordingly, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 19–61 and 63–81 of the '740 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '740 patent shall commence on the date of this Decision, and notice is hereby given of the institution of trial.

¹¹ Patent Owner should take note that, as of July 24, 2003, the revised interim Director Review process allows for parties to request Director review of decisions to institute review. See <https://www.uspto.gov/patents/ptab/decisions/revised-interim-director-review-process>.

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