

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
U.S. Patent No. 10,689,740

PATENT OWNER'S PRELIMINARY RESPONSE

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EXHIBIT LIST

Exhibit	Description
2001	Declaration of Mark Cohen
2002	Cohen Resume
2003	EO13817
2004	EO13953
2005	EO14017
2006	Komesaroff, Make the Foreign Serve China
2007	Declaration of Andrew Sherman
2008	Disclaimer in Patent under 37 CFR 1.321(a)
2009	Electronic Acknowledgement Receipt of Ex. 2008.
2010	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 134, Terves Motion for Summary Judgment
2011	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 134-21, Ecometal Invalidity Contentions
2012	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 144, Defendants Response to Motion for Summary Judgment
2013	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 178, Summary Judgement Order
2014	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 203, Judgment.
2015	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 219, Permanent Injunction Memorandum Opinion
2016	<i>Terves, LLC v. Yueyang Aerospace New Materials Co. Ltd. et al.</i> , Case No. 1:19-cv-1611 (N.D. Oh.), ECF 220, Permanent Injunction
2017	Medlin Declaration during Reexamination
2018	Swanger Declaration during Reexamination
2019	Redline from '653 patent to '740 patent
2020	Application Data Sheet for '740 patent
2021	Specification for '740 patent
2022	IDS for '740 patent
2023	IDS signed for '740 patent

Exhibit	Description
2024	IDS signed (second time) for '740 patent
2025	First Amendment for Ex Parte Reexamination

I. INTRODUCTION

The Board should not institute the Petition for *Inter Partes* Review (Paper 2 (“Petition” or “Pet.”)) that challenges the patentability of claims 1-81 (the “Challenged Claims”) of U.S. Patent No. 10,689,740 (the “’740 patent”) filed by Petitioner Chongqing Yanmei Technology Co., LTD (“Petitioner”).

As an initial matter, Patent Owner Terves, LLC (“Terves” or “PO”) has disclaimed claims 1-18 and 62 of the ’740 patent; thus, the Board cannot institute proceedings on them and Petitioner’s arguments are moot. As such, only claims 19-61 and 63-81 (the “Remaining Claims”) are at issue here.

The Board should deny institution for the Remaining Claims for two independent reasons. First, this is a textbook case for discretionary denial. Every prior art reference was identified during prosecution. In fact, the USPTO vetted closest reference Xiao on the same grounds raised by Petitioner in both prosecution and reexamination, and a U.S. district court determined the ’740 patent claims valid over Xiao as well. The Board here would literally have to overturn a district court and multiple USPTO examiners pre- and post-issuance to institute. Moreover, strong policy reasons exist for the Board to deny the Petition. Mainly, this Petition threatens the domestic supply chain in processed magnesium used in the fracking industry in violation of a critical mineral National Emergency.

Second, none of the Petitioner’s four grounds establish a “reasonable likelihood” that the petitioner would prevail as to at least one claim. For example, for Ground I, because claim 19 (and its dependents) have full written description support in the application that published as Doud, Doud is not anticipatory prior art but rather a proper cited priority application. Ground II cannot meet this standard because Xu teaches away from metal alloys formed by casting from a melt. Ground III fails because PO disclaimed claim 1. Ground IV fails because the USPTO already determined in reexamination that Xiao does not disclose in situ precipitates formed from copper, nickel, and/or cobalt.

Therefore, the Board should deny institution.

II. BACKGROUND

A. Although a small company, Terves is the market leader in the U.S. for dissolvable magnesium alloys.

Terves is a small company in Euclid, Ohio with roughly 45 employees. Terves built the first secondary magnesium processing plant in 50 years in the United States, dedicated to manufacturing, among other things, the claimed invention of the ’740 patent. Ex. 2007 ¶¶1-2, 4. Terves produces numerous magnesium finished commercial products, including products for frack ball/plugs and other oil and gas tool components. *See, e.g.*, Ex. 2007 ¶2; Ex. 2013, at 2; Ex. 2015, at 3.

Here’s how fracking works: a fracking company drills a well miles below ground, segments the well with tools called “frac plugs” and “frac balls,” pressurizes

the well to create fractures in the ground, and then extracts the oil that seeps from the fractures. Prior to Terves' patented invention, companies had used either thermoplastic plugs or powder metallurgy to construct such tools. Thermoplastic plugs were undesirable because workers had to grind those plugs into small pieces and push large amounts of water into the holes to flush out those pieces. This is a significant reason fracking has a negative environmental view: the use of thermoplastic plugs requires significant amounts of water pumped into the wells to remove the small pieces of thermoplastic.

Powder metallurgy, which for example is the Xu reference, was known. However, powders were not a suitable solution in the industry because magnesium powder is dangerous to handle, powder metals are cost prohibitive, and when compacted to form fracking tools, those tools were brittle and could break under pressure while used for fracking.

Terves turned the fracking industry on its head in 2014. Through research, hard work, and ingenuity, Terves' metallurgists invented novel formulations for cast magnesium alloys. The cast magnesium is melted to form billets, and machine shops can then machine them into frac plugs or frac balls. Terves' inventors discovered that by melting magnesium or magnesium alloys, mixing them with certain additives (nickel, copper, and/or cobalt) at certain amounts, and then cooling the material into a cast creates in situ particles in the cast. Those in situ particles provide the billets –

and ultimately frac balls and plugs – greater strength and ductility than brittle powder metals formed from compaction.

Terves was the first company in the world to develop dissolvable cast magnesium formulations that formed better fracking tools than any other tool in the market. Ex. 2007 ¶4. Terves' patented cast magnesium also provided more controlled dissolution rates while the frac tools are in the fracking well than do powder metallurgy tools. Best of all, Terves' superior cast magnesium fracking plugs and balls are less expensive than powder (less than half the cost), and cheaper than thermoplastics especially when accounting for all of the water wasted in removing thermoplastic from out of the ground versus the dissolution the tools with salt water that occurs with Terves' tools.

Terves has filed for and received from the USPTO and patent offices around the world patents protecting its novel and inventive dissolvable cast magnesium composites. Unfortunately, Terves' competition in the market are cheap, knock-off dissolvable magnesium imported from China that infringe Terves' patents, which has caused serious harm to Terves' business. In fact a district court already has granted a permanent injunction against an importer who was bringing from China into the U.S. dissolvable cast magnesium that infringes the '740 patent. Ex2015; Ex. 2016.

B. Terves never heard of Petitioner, and Petitioner has no known U.S. presence.

This is an odd petition. While Terves knows the magnesium and oil/gas markets well, Terves never knew or heard of Petitioner until Petitioner filed this IPR. Ex. 2007 ¶8. The U.S. Importation Records do not bear Petitioner's name for any product imported into the United States. Terves never accused Petitioner of infringement. Petitioner appears to be a non-practicing Chinese corporation without any known U.S. presence, was never threatened by Terves, is unknown to Terves, and is only asserting prior art that is either owned by Terves or has been fully vetted by both the USPTO and district court.¹

¹ As Petitioner acknowledges, Terves has been involved in a dispute with a Chinese national and importer: Nick Yuan and Ecometal ("Ecometal"). Terves prevailed at trial in prior IPRs (IPR2020-01620 & IPR2020-01621) and reexamination on the '740 patent's parent on similar claims. It is not clear whether Petitioner is connected to Ecometal (or other parties Terves has enforced against) and fighting for Ecometal by proxy or if Petitioner is simply an independent Chinese corporation with an undisclosed agenda. Both scenarios underscore why discretionary denial is appropriate, especially where Petitioner repackaged the same prior art previously vetted.

C. The '740 patent correctly claims priority back to April 18, 2014.

To protect its investment and position in the market, Terves has expended significant resources to patent its inventions. On April 18, 2014, Terves filed provisional application 61/981,425, and then application 14/689,295 on April 17, 2015, which published as Doud and issued as U.S. Patent No. 9,903,010 (“’010 patent”). On July 5, 2017, Terves filed divisional application 15/641,439, which has the same substantive specification as Doud and issued as U.S. Patent No. 10,329,653 (“’653 patent”).

The ’740 patent is a CIP application claiming priority to all of these applications. As set forth in Section V(A) below, each of the ’425 provisional application, Doud, and the ’653 patent fully support claim 19 and its dependents, *i.e.*, the new matter in the ’740 specification is not the basis for the subject matter in those claims.

The ’740 patent discloses a “dissolvable magnesium cast composite” Ex. 1001, claims 19, 94. Exemplary environments where the invention may dissolve are “salt water, brine, [and] fracking liquids.” *Id.* at 5:59. Embodiments of the alloy are suited for use to make “a ball or other tool component in a well drilling or completion operation such as, but not limited to, a component that is seated in a hydraulic operation that can be dissolved away after use so that no drilling or removal of the component is necessary.” *Id.* at 2:19-24.

Claim 19 is independent and can be read using Petitioner's breakdown of limitations in its chart set forth in Exhibit 1004.²

D. Terves previously litigated and prevailed on validity of the '740 patent.

On July 15, 2019, Terves sued several defendants for importing dissolvable magnesium from China that infringed the '740 patent and two related Terves patents: the '010 and '653 patents. Terves sued Nick Yuan (the Chinese importer), Ecometal Inc. (Mr. Yuan's importation company), and Yueyang Aerospace New Materials Co. Ltd. (the Chinese manufacturer). Yueyang never responded and was dismissed without prejudice. *Terves LLC v. Yueyang Aerospace New Materials Co. Ltd.*, No. 1:19-cv-01611-DCN. Ex. 2013; Ex. 2015; Ex. 2016.

Terves sued on the '010 and '653 patents, and amended its complaint to add the '740 patent after it issued. Ecometal and Yuan (collectively, "Ecometal") asserted anticipation and obviousness claims against all three patents.

Ecometal relied primarily upon Xiao, making the nearly identical argument that Petitioner makes in Ground IV: Xiao's statement in paragraph [0026] that "Fe,

² Petitioner only identified the individual elements of the claims in Ex. 1004 but did not do so in the Petition that barely made it under the word count. The law prohibits petitioners from performing an end-around to the word-count limit. 37 CFR §42.24. This is another reason for discretionary denial.

Cu, Ni, Ag, etc., in the magnesium alloy can form a large number of intermetallic composite micro-particles” equates to the “said additive forming metal composite particles or precipitant in said magnesium composite, said metal composite particles or precipitant forming in said in situ precipitation of said galvanically-active intermetallic phases.” Ex. 1001, 26:62-65.

Although Ecometal obviously was aware of Xu and Doud as both were cited during prosecution of the '740 patent, and Terves was suing Ecometal for infringement on Doud (which issued as the '010 patent), Ecometal did not view those references as invalidating and did not raise either reference. Instead, Ecometal confirmed the '740 patent claims benefited from the April 18, 2014 priority date of the provisional application. Ex. 2011, at 3.

Ecometal engaged a metallurgical expert to offer invalidity opinions against the '740 patent based on Xiao. The district court entered summary judgment of no invalidity on many claims of the '740 and '653 patents, including many of the claims challenged by Petitioner here. Ex. 2013. A jury awarded Terves lost profit damages of \$707,207 on various claims of the '740 and '653 patents. Ex. 2014. Ecometal appealed to the Federal Circuit, appellate briefing is complete, and oral argument should occur this summer, although no date has been set.

E. The USPTO's Reexamination.

Prior to trial, Ecometal also petitioned the USPTO on an *ex parte* reexamination against the parent '653 patent. As in litigation, Ecometal submitted a 151-page petition (Ex. 1008) and a 144-page, 408-paragraph expert declaration (Ex. 2017).

Ecometal again argued Xiao's paragraph [0026] teaches the use of iron, copper, and nickel as additive materials to create the in situ precipitant that drives dissolution—the same theory in Ground IV here.

Terves responded with a rebuttal report by expert metallurgist Dr. Lee Swanger. Dr. Swanger explained that Xiao uses aluminum—and not iron, copper, or nickel—as the additive material to form the precipitates that drive the dissolution of the material. Ex. 2018 ¶¶37-38, 49-51, 53-54.

The USPTO agreed with Dr. Swanger's opinions, rejected Ecometal's Xiao-based challenge, and upheld validity. The USPTO reiterated that Xiao teaches the use of aluminum to form the precipitates that drive dissolution. Ex. 1009. The USPTO determined that Xiao's [0026] mentioning the possibility of iron, copper, and nickel forming micro-particles does not suggest that those materials could be substituted for the primary element of aluminum used in all Xiao-disclosed examples:

Xiao is the closest prior art and it fails to teach a magnesium alloy that includes 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 materials 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 (emphasis added).) Thus, the USPTO twice decided that Xiao does not invalidate,³ and the district court ruled the same when it granted summary judgment of no invalidity.

F. Terves statutorily disclaimed claims 1-18 and 62.

The '740 patent issued with claims 1-103. Petitioner only challenged claims 1-81 here; however, Terves has disclaimed claims 1-18 and 62. Ex. 2008; Ex. 2009. Thus, only claims 19-61 and 63-81 remain.

G. The prior art cited in the Petition were all part of the '740 patent prosecution history and vetted in litigation or in reexamination.

1. Doud (Ex. 1005)

Doud is the grandparent application from which the '740 patent claims priority. Since the filing date for the '740 patent application, Terves identified Doud as a priority application. *See* Ex. 2020, at 3 and Ex. 22021, at 1. The USPTO always was aware of Doud (and the '653 patent) during examination of any of its children

³ Terves also cited Xiao during the '740 patent prosecution, which the examiner issued over Xiao.

applications, including the continuation-in-part that led to the '740 patent. As explained more fully below, the Remaining Claims were not part of any new material added during prosecution and are fully supported by the parent applications.

2. Xiao (Ex. 1006)

Xiao is a Chinese application exhaustively considered. Its formulation requires a high amount of aluminum, which is completely different from the claimed formulations. Ironically, Petitioner provided the Board a copy of the Xiao translation used in litigation and reexamination where Xiao already failed to invalidate. Xiao does not invalidate any '740 patent claim.

3. Xu (Ex. 1007)

Xu is an application issuing as U.S. Patent No. 9,016,363 that Terves cited during prosecution of the '740 patent. Not surprisingly, the USPTO did not cite Xu as part of a rejection against any of the '740 patent claims. That is because Xu teaches a completely different – and inferior – powder alloy that the industry disliked. Because a POSITA would readily recognize Xu's very different and inferior powder chemistry from the cast magnesium alloy recited in the claims, Xu does not come close to invalidating. In fact, neither Ecometal ever cited to Xu's inferior powder metallurgy in litigation or reexamination. This alone should end the inquiry. As explained below, Xu does not disclose multiple claimed limitations in claim 19 so it cannot possibly anticipate or render obvious the claims.

III. BECAUSE TERVES DISCLAIMED CLAIMS 1-18 AND 62, INSTITUTION IS BARRED ON THEM.

While Terves disagrees with Petitioner’s contentions for claims 1-18 and 62, Terves has statutorily disclaimed these claims under 35 U.S.C. §253(a). Ex. 2008; Ex. 2009. “No *inter partes* review will be instituted based on disclaimed claims,” so the Board must deny institution as to them. 37 C.F.R. §42.107(e). *Gen. Elec. Co. v. United Techs. Corp. et al.*, IPR2017-00491, Paper 9 (PTAB July 6, 2017) (precedential). Only claim 19 and dependent claims 20-61 and 63-81 remain. As set forth below, the Board also should deny institution for those claims.

IV. THE BOARD SHOULD EXERCISE ITS DISCRETION TO DENY INSTITUTION.

Institution of an IPR is entirely discretionary—“the PTO is permitted, but never compelled, to institute.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018) (“314(a) invests the Director with discretion on the question whether to institute review...”).

A. The Board should deny institution under §325(d).

The Petition’s complete reliance on references and arguments extensively analyzed during prosecution, litigation, and reexamination warrants discretionary denial because the “same or substantially the same prior art or arguments” have been considered. 35 U.S.C. §325(d).

The Board applies a two-prong framework. *Advanced Bionics v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020). The first prong considers “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.” *Id.* at 8 (citing *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017)). Under the second prong, “if either condition of [the] first part of the framework is satisfied, [the Board determines] whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.” *Id.* Here, both prongs warrant denial.

1. The Petition relies on the same art and arguments already considered.

This first prong considers *Becton* factors: (a) similarities and differences between the asserted art and prior art involved during examination; (b) cumulative nature of the asserted art and evaluated art; and (c) the overlap between arguments made during examination and petitioner reliance on the prior art. *See Becton*, IPR2017-01586, Paper 8, 17–18.

Xiao

Ground IV of the petition relies on the same art (Xiao) and argument (Xiao [0026] discloses iron, copper, or nickel in magnesium alloy can form “intermetallic

composite micro-particles” equates to the “in situ precipitate” of claim 19) already considered and rejected by the district court and by the USPTO in reexamination.

At the district court, Ecometal argued that Xiao anticipates the ’740 patent claims. Ex. 2010 at 4-9; Ex. 2012 at 8. Ecometal argued that Xiao’s reference to iron, copper, and nickel satisfied the “additive material” limitations in the claims of the ’740 and ’653 patents. *See Id.* This is the same argument by Petitioner here. Pet. 72. The district court ruled Ecometal did not prove that Xiao invalidates and granted summary judgment of no invalidity on 53 claims of the ’740 patent at issue here. Ex. 2013.

In reexamination, Ecometal argued that Xiao discloses the in situ precipitate in the claims of the ’653 patent. Ecometal again relied on [0026], which states that iron, copper, and nickel can be added to and “can enhance the corrosion performance of the magnesium alloy.” Ex. 1008, at 27-28. This is the exact same argument that Petitioner makes in Ground IV. Petitioner argues Xiao’s [0026] discloses iron, copper, and nickel that form the “in situ precipitate” recited in claim 19 of the ’740 patent. Pet. 72. Although the reexamination addressed claims in the ’653 patent, it is the identical, substantive issue: claim 19 recites that the “additive material” includes one or more metals selected from the group consisting of “a) copper ..., b) nickel ...,

and c) cobalt” and that the “in situ precipitate” includes that “additive material.”⁴ The USPTO disagreed, determining that Xiao does not teach this limitation. Petitioner’s identical argument and should be rejected in the same manner.

In concluding *ex parte* reexamination, the USPTO correctly rejected Ecometal’s reading of Xiao. Ex. 1009, at 4. It ruled that Xiao teaches aluminum to form the particles that drive dissolution, and not the secondary elements of copper, nickel, or iron. *Id.* The USPTO affirmed patentability on that basis. *Id.*

Because the USPTO and district court both considered and rejected the very same argument that Petitioner makes here—that Xiao teaches the use of iron, copper, and nickel as additive materials to form precipitates to drive dissolution—the Board should not reconsider those decisions and should decline to institute.

Doud

Doud was well known during ’740 patent prosecution. The ’740 patent claims priority to Doud, the ’653 patent, and the provisional at the time of filing the

⁴ For example, claim 1 of the ’653 patent recites an “additive material” including one or more metals selected from the group consisting of “copper, nickel, iron, and cobalt” to “form[] precipitant.” This limitation is materially the same as claim 19 which recites an “additive material” including one or more metals selected from the group consisting of “copper... nickel... and cobalt” to form “in situ precipitate.”

application for the '740 patent. Ex. 2020, at 3; Ex. 2021, at 1. Terves also cited Doud in an IDS that the Examiner acknowledged, considered, and signed twice. Ex. 2022, at 6; Ex. 2023, at 6; Ex. 2024, at 6. Doud appears **three** times on the face of the '740 patent. Ex. 1001, 1-3 and 8. There is nothing more the Applicant could have done to present Doud to the Examiner during prosecution as supporting the present claims, and the Examiner allowed the '740 patent with priority claims to Doud.

Xu

Xu was well known to the Examiner during prosecution. In both the '653 patent and the '740 patent, Terves listed Xu in the IDS, as cited on the face of those patents. Notably, the only reason Xu was not been vetted like Xiao is because it has no relevance to the Challenged Claims since it teaches a completely different powder metallurgy, and in fact states that its formulations are not usable for cast metallurgy. Ex. 1007 ¶59, *See Boragen, Inc. v. Syngenta Participations AG*, IPR2020-00124, Paper 16 (PTAB May 5, 2020), at 27 (exercising discretion under Section 325(d) by finding a reference “less relevant” than what was considered by the examiner, thus making it “substantially the same” and “cumulative” under the *Advanced Bionics* analysis).

2. Petitioner has not alleged, let alone shown, material error.

This second prong under *Advanced Bionics* considers *Becton* factors: (1) extent the asserted art was evaluated during examination; (2) whether petitioner has

pointed out sufficiently how the examiner erred in evaluation of the asserted art; and (3) the extent to which additional evidence and facts warrant reconsideration of the prior art or arguments. *See Becton*, IPR2017-01586, Paper 8 at 17–18.

“If a condition in the first part of the framework is satisfied and the petitioner fails to make a showing of material error, the Director generally will exercise discretion not to institute” *Advanced Bionics*, IPR2019-01469, Paper 6 at 8–9. Despite overwhelming evidence that the Petition presents the same failed art and arguments already presented to the USPTO and district court, Petitioner does not even suggest a material error occurred. That should end the inquiry in favor of denying institution.

There is no dispute that every word in Xiao has been closely – and repeatedly – examined by both the USPTO Examiner and Reexamination Unit. And all of them come to the same conclusion: Xiao does not teach in situ precipitates formed from copper, nickel, and/or cobalt. Petitioner did nothing to explain how this conclusion for Xiao is erroneous especially after the USPTO has been presented and analyzed hundreds of pages of expert testimony on this issue. Based on this record, the Board should use its discretion in the USPTO’s prior finding that Xiao does not disclose the claimed in situ precipitate.

The same goes for Doud. The USPTO examiner, the adverse parties such as Ecometal, and the Reexamination Unit closely analyzed the specification with the

claims following the law regarding open-ended ranges, and have never found a lack of adequate disclosure issue under § 112 on that basis. Petitioner has done nothing to address the fact that it is taking a position that contradicts the law and the one taken by the USPTO and by opponents to the '740 patent (and/or the '653 patent). The law does not support Petitioner's incorrect argument regarding literal specification for an entire portion of open-ended claim ranges. In fact, Petitioner admits that because a POSITA would understand the Doud description to support a range of 0.01-35 wt. % of in situ precipitates that description somehow does not support values of at least 0.01 wt. % as recited in claim 19. The truth is that the only party who has made a mistake here is Petitioner in making the legally (and logically) incorrect argument of admitting specification support in Doud but then arguing that the specification doesn't do so.

Further, as for Xu, only a layperson non-POSITA who knows nothing about metallurgy would find any relevance in powder-based applications in Xu. That of course is not the legal standard: a POSITA would readily understand the overwhelming difference between Xu and the claims and the complete lack of relevance in Xu's powder teachings and caution against using cast melts. Xu has always been of record before the USPTO. If it had any relevance to patentability, there is no doubt Ecometal a company with significant knowledge about magnesium

alloys – would have cited Xu in its invalidity positions at reexamination and the district court.

Neither the USPTO nor the adversarial parties ever cited to Xu as anticipatory or obvious prior art because Xu itself states to a POSITA that its composite formulations work only for powder and not for cast alloys: “**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.**” Ex. 1007 ¶59. Far from error, the USPTO and Terves’ adversaries correctly did not to use Xu to attack the validity of the claimed cast magnesium alloys in the ’740 patent.

While a POSITA would readily understand the incredible differences in metallurgy between powder and cast metals as did the Xu reference itself, Dr. Nava (Petitioner’s expert) and Petitioner failed to even address to the Board such differences in Xu that a POSITA would have readily known. It was wrong for Petitioner and its expert to try and sneak by the Board those dispositive differences to argue that parties such as the USPTO and Ecometal somehow must have missed what Xu discloses. That is not true and there is no evidence to support that false, implausible theory. The USPTO and Ecometal reviewed the record closely including Xu, determined that Xu is a different chemistry than what is claimed, and determined

that Xu teaches away from that which is claimed. The Board should reject Petitioner's incorrect, speculative attorney argument contradicted by evidence in Xu.

The Board should not invest its valuable resources in yet another review of the same evidence. The Board should use its discretion to deny institution.

B. The Petition should be rejected under §314(a) and §316(b) based on the critical mineral National Emergency and related reasons.

Unlike a typical IPR petition, the economic and regulatory backdrop here uniquely compels discretionary denial. Respondent Terves is a 45-employee business operating in Ohio and is the only American company manufacturing the patented cast magnesium composites. Ex. 2007 ¶1. Terves built the only secondary magnesium processing plant in the U.S. the past 50 years, which is dedicated to manufacturing the claimed invention of the '740 patent. Ex. 2007 ¶4. This is critical because of the continuing critical mineral processing "National Emergency" declared by President Trump and continued under President Biden. Magnesium is one of thirty-five declared "critical" minerals, and its processing is protected under Executive Order 13953. Ex. 2004 ("EO13953"); Ex. 2001 ¶¶15-23.

Under EO13953, based on the "National Emergency," it is an Executive Branch order that every federal agency must "prioritize" the "protection of the domestic supply chain" for domestic critical minerals, in a manner that "expands, and strengthens commercially viable critical . . . minerals processing capabilities," to the extent allowed by law. Ex. 2001 ¶20. The '740 patent, and Terves' commercial

products within its scope (fracking equipment used in the energy sector), fall within protections of EO13953. Ex. 2001 ¶22. EO13953 itself recognizes the fracking industry (with its need for critical minerals subject to the National Emergency) as “vital to the energy independence of the United States.” Ex. 2001 ¶18.

Granting this Petition would threaten (not protect) the domestic supply chain in processed magnesium used in the oil/gas industry. The Petition attacks a domestic entity’s property rights, and is intended to eradicate one of Terves’ hard-won competitive advantages—its ability to protect via the patent system its innovative dissolvable fracking equipment from brazen foreign copyists. Despite a false, unsworn statement of a “reasonable apprehension of suit” (Pet. 75), the purported Petitioner has no known U.S. marketplace presence.

Though the Petition has no substantive merit, instituting trial would deplete Terves’ crucial funds, resources, time and attention that Terves should instead devote to expanding its plant and marketplace footprint, to help our nation address the National Emergency. Ex. 2007 ¶12.

Terves, of course, respects the right of any person (of any national origin) to use lawful processes to test the strength of any party’s IP rights, if such person acts in good faith. But by Petitioner’s own admission, discretionary denial will not prejudice Petitioner’s ability to do so. Taking Petitioner at its word, its “reasonable apprehension of suit” (Pet. 75) means that Article III courts will allow it someday to

file a declaratory judgment action once it actually sells infringing products into the U.S. if it believes it has a good faith basis to invalidate the '740 patent. Especially in the context of the ongoing National Emergency, the Board as an agent of the Director (who is Under Secretary of Commerce for Intellectual Property—a leader within one of the federal agencies subject to EO13953) should not allow itself to be used as an instrumentality of a foreign enterprise (possibly a foreign sovereign) to weaken critical domestic supply chains. Ex. 2001 ¶¶51-57.

The accompanying expert declaration of Mark Cohen explains in detail why considerations of Chinese industrial policy, in view of the foregoing facts, should lead to discretionary denial. Ex. 2001. Professor Cohen (who speaks Chinese with native fluency) honorably served the USPTO in several capacities related to China's intellectual property diplomacy, is now a UC Berkeley law professor, and publishes the respected "ChinaIPR" blog. Ex. 2001 ¶3. Professor Cohen names numerous interlocking factors that together suggest that the present Petition serves ulterior motives far afield from those that drive good faith IPR petitions.

Professor Cohen explains in detail that it is the policy of the Chinese government to set up corporate entities to conduct what has been termed "lawfare" (*i.e.*, warfare by invocation of legal process) against foreign adversary commercial enterprises. Ex. 2001 ¶¶38-50. The aim is to harass and drain resources. Ex. 2001 ¶47. The Chinese government has specifically sought to enhance its internal

magnesium processing capacity, including through disassembly of Western plants for reassembly in China, and by promoting trade secret and IP theft in the metals sector. Ex. 2001 ¶¶24-26. The Chinese government also unfairly biases its domestic intellectual property legal landscape against foreign small and medium sized enterprises (SMEs), such as Terves, particularly in areas that its industrial policy has targeted. Ex. 2001 ¶¶59-69.

Terves happens to operate in four of the ten sectors China has prioritized within its Made in China 2025 10-year plan. Ex. 2001 ¶32. Likewise, magnesium appears 11 times in the “14th Five Year Plan of Chongqing for High-Quality Development of Manufacturing Industry (2021-2025).” Ex. 2001 ¶35. Here, considerations of the effect on the economy, no less the integrity of the patent system, counsel that the Board should reject any potential invitation to become an instrument of “lawfare,” in service of a rival foreign industry, especially in view of the protections for domestic supply chains in critical minerals under EO13953. Ex. 2001 ¶¶70-72.

It is unknowable without powerful tools of litigation discovery (such as would be available in federal court) whether the present Petitioner acts as a shill of the Chinese government, emplaced to “soften” a domestic critical mineral processor through these proceedings (the typical “lawfare” paradigm). Petitioner’s internet presence is nearly nonexistent, confounding attempts to either confirm or disprove

this possibility. Professor Cohen has identified numerous “real party in interest” flags pointing to influence by the Chinese government on these proceedings. Ex. 2001 ¶¶41-50. However, the Petition does identify Mr. Huang Guangsheng as the “largest shareholder and legal representative” of Petitioner. Pet. 1.

A person with that name co-authors papers as a magnesium researcher from “Chongqing University - National Engineering Research Center for Magnesium Alloys.”⁵ That institution boasts on its English language web page that it has long been “approved by the Minister of Science and Technology of China,” is “funded by national and provincial funding agencies,” and is “[b]ack-upped [sic] by the funds from National ‘211 Project’, ‘985 Project’ and government R&D projects.”⁶ Professor Guangsheng appears to be a member of the Chinese Communist Party. Ex. 2001 ¶43. Thus, neither Terves nor the Board can rule out that Professor Guangsheng acts for his country. Petitioner’s efforts might very well be the latest example of Chinese government “lawfare” attempted against the U.S. and its critical industries.

In the case of magnesium processing in particular, Chinese government industrial policy implementers would be aware of the deleterious effect on margins (and company survivability) of any costly and distracting legal process against a

⁵ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4455118

⁶ <http://ccmg.cqu.edu.cn/English/index.htm>

small United States entity, especially in the margin-challenged metals sector. Ex. 2001 ¶¶27-30. Terves is particularly vulnerable in this regard. It suffers the double whammy of its own inputs costing more because of the ITC's pure magnesium antidumping duties (renewed in May 2023 based on China dumping behavior in the metals sector), whereas many finished-product foreign competitors do not pay such duties. Ex. 2001 ¶¶29-30; Ex. 2007 ¶11.

Terves faces the ever-present threat (ironically in view of ITC actions *punishing* China's magnesium sector) of having to compete for the same customers against Chinese companies who sell finished products below Terves' own costs of goods sold. Ex. 2001, ¶¶29-30; Ex. 2007, ¶11. Thus, if the present Petition is in fact the latest example of Chinese government "lawfare" against the U.S. and its critical industries, it is one that has high potential to damage national interests.

For these reasons, the Board should exercise its discretion to stay on the sidelines. To be clear, Terves does not ask the Board to make any policy judgments or findings against Petitioner, the Chinese government, or anyone's motives for petitioning for IPR. To the contrary, Terves requests that the Board respect Professor Cohen's opinion that it should *not* wade into such delicate matters of foreign and economic policy. Ex. 2001 ¶¶70-72. The way the Board should do so is to employ its own wide discretion, and *not* institute trial. Petitioner is not prejudiced, since it represented itself to have standing to sue for invalidity anyway in U.S. District Court.

The Board risks contravening a direct Order of the President if it does institute trial. Ex. 2001 ¶56. Among other authorities, subsection 203(a)(1)(B) of International Emergency Economic Powers Act (IEEPA, 19 U.S.C. §1701-1707) authorizes the President to “investigate, block during the pendency of an investigation, regulate, direct and compel, nullify, void, prevent or prohibit, any acquisition, holding, withholding, use, transfer, withdrawal, transportation, importation or exportation of, or dealing in, or exercising any right, power, or privilege with respect to, or transactions involving, any property in which any foreign country or a national thereof has any interest by any person, or with respect to any property, subject to the jurisdiction of the United States[.]” EO13953 issued under the IEEPA. In turn, EO13953 invokes the IEEPA to require federal agency “protection” of critical mineral supply chains, to “expand” and “strengthen” our domestic mineral processing capabilities.

An agency (such as the Board) is forbidden by Presidential Order from allowing itself to be used as a tool of a foreign entity to diminish a critical magnesium processor’s prospects in the fracking equipment marketplace. The Board has ample authority (under IEEPA subsection 203(a)(1)(B) and under 35 U.S.C. §§314(a) and 316(b)) not to proceed. Instituting trial would magnify Terves’ costs of operation with litigation expenses and distractions. Ex. 2007 ¶12. This would create unnecessary strains and risks on Terves’ operations and margins. Since

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, the Board should deny institution.

V. THE PETITION FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF SUCCESS TO PREVAIL.

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). That burden never shifts to the PO. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner has fallen far short of establishing that burden here.

A. Ground I—the Remaining Claims are not anticipated by Doud.

1. Because Doud fully supports claim 19, Doud is not prior art.

Doud cannot serve as a basis to anticipate claim 19 of the ’740 patent. Claim 19 is fully supported by the disclosures of its parent applications: the ’653 patent (its direct parent) and Doud (its grandparent). Therefore, claim 19 is entitled to the benefit of the priority date of its earliest-filed parent application, *i.e.*, Doud.

Since the parent applications are a proper basis for priority, they cannot as a matter of law serve to anticipate claim 19 as relied on by the Petitioner. 35 U.S.C. §120. The Board should deny institution.

A claim in a continuation-in-part (CIP) is entitled to the full benefit of an earlier filing date when the claim: (1) recites subject matter supported by an earlier

application; and (2) claims priority to that earlier application. *Nat. Alternatives Int'l, Inc. v. Iancu*, 904 F.3d 1375, 1383 (Fed. Cir. 2018). Priority in a CIP is assessed on a claim-by-claim basis. *Id.* Claims supported under 35 U.S.C. §112 by the earlier parent application have the effective filing date of that earlier parent application. MPEP §2152.01(B).

Written description support is viewed from a POSITA's perspective. The written description "must clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed." *Ariad Pharm., Inc. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (citing *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1562–63 (Fed.Cir.1991)). The test for written description support is whether the disclosure "conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.*

For written support of claims reciting open-ended ranges, the Board has consistently held that open-range ranges are fully supported by the written description when the written description identifies an upper limit a POSITA would understand. *Ex Parte Zai-Ming Qiu & Miguel A. Guerra*, No. 2020-001512, 2020 WL 8185957, at *2 (PTAB Nov. 25, 2020) (citing *Anderson Corp. v. Fiber Composites, LLC*, 474 F.3d 1361 (Fed. Cir. 2007)). The parent application supports open-ended ranges when "there is an inherent, albeit not precisely known, upper limit and the specification enables one of skill in the art to approach that limit." *Id.*

In *Zai-Ming Qiu*, the Board held that the open-ended limitation “greater than 2” had written description support in the disclosure where the specification disclosed examples wherein the average number of anionic groups range from 2.09 to 15. *Id.* The finding of written description support for the open-ended range for the anionic groups was based in part on the claim reciting a value for the molecular weight of the compound so that the “specification as a whole enables one of ordinary skill in the art to determine the inherent upper limit on the number of anionic groups for any particular compound circumscribed by the claimed requirements.” *Id.*

Moreover, open-ended ranges are not interpreted so strictly so as to render the claims unworkable. *Application of Kirsch*, 498 F.2d 1389, 1394 (C.C.P.A. 1974). For example, the claim limitation in *Kirsch* required that the amount of one ingredient in the reaction mixture should “be maintained at less than 7 mole percent,” the C.C.P.A. found the Examiner incorrectly determined the open-ended range is inclusive of substantially no ingredient resulting in termination of any reaction. *Id.* Rather, a POSITA would understand “[t]he imposition of a maximum limit on the quantity of one of the reactants without specifying a minimum does not warrant distorting the overall meaning of the claim to preclude performing the claimed process.” *Id.*

As an initial matter, 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. Ex. 1005 and Ex. 1002. For example, Doud and the '653 patent are nearly identical except for the priority cross-reference, the claims, and Col. 11, ll. 26-Col. 13, ll. 57 of the '653 patent which duplicate the paragraphs 31-41 of Doud (Doud recites method claims and '653 patent recites apparatus claims based on same specification). Ex. 1005 and Ex. 1002. No new matter is introduced in the '653 patent. Because those written descriptions are substantially the same, both of them as set forth below provide written description support each limitation in claim 19 and the dependent claims.

The following table shows how Doud supports each and every limitation in claim 19:

Claim 19	Doud Support	Is this limitation cited for the first time in the new matter portion of '740 Patent?	Petitioner's and Expert's Position
A dissolvable magnesium cast composite comprising:	Abstract [0002], [0005], [0006], [0008], [0045]-[0047], [0049], [0052], [0053], [0057]	No, <i>see</i> Ex. 2019 (showing redline)	Petitioner does not dispute [19pre] is supported by Doud. Petition 22-24 & 39, citing Doud ¶¶[0045], [0046], [0047].

a mixture of magnesium or a magnesium alloy and	Abstract [0002], [0005], [0006], [0008], [0045]-[0047], [0049], [0052], [0053], [0057]	No, <i>see</i> Ex. 2019 (showing redline)	Petitioner does not dispute Doud supports [19a]. Petition 22-24 and 39, citing Doud ¶¶[0045], [0046], [0047], [0014], [0015].
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,	[0012]-[0030], [0032]-[0035], [0045]-[0047], [0051], [0053], [0057] Claims 1, 16-22, 26-28	No, <i>see</i> Ex. 2019 (showing redline)	While Petitioner alleges [19b] is not supported by Doud, it admits Douds supports values below 35%. Petition 22-24 and 39-40, citing ¶¶[0045], [0046], [0053], [0047], [0014], [0015], [0019], [0020], [0021], [0022].

said magnesium composite includes in situ precipitate, said in situ precipitate includes said additive material,	[0011]-[0030], [0032]-[0035]	No, <i>see</i> Ex. 2019 (showing redline)	Petitioner does not dispute Doud supports [19c]. Petition 22-24 and 40, citing ¶¶[0012], [0013], [0014].
a plurality of particles of said in situ precipitate having a size of no more than 50 µm,	[0006], FIGs. 1-2	No, <i>see</i> Ex. 2019 (showing redline)	Petitioner does not dispute Doud supports [19d]. Petition 22-24 and 40, citing ¶¶[0006].
said magnesium composite has a dissolution rate of at least 5 mg/cm ² /hr. in 3 wt. % KCl water mixture at 90° C.	[0045]-[0047], [0053]-[0058] Claim 31	No, <i>see</i> Ex. 2019 (showing redline)	Petitioner does not dispute Doud supports [19e]. Petition 22-24 and 40, citing ¶¶[0045], [0046], [0047].

Therefore, a POSITA would readily find written description support for claim 19 in Doud, and claim 19 is not based on the new matter added into the specification for the '740 patent as the CIP portion.

As shown in the table above, Petitioner does not dispute that Doud supports each and every limitation in claim 19 except for one: 19[b]. Petition, 22-24 (only raising 19[b] as not supported by Doud). Both the Petition and the Petitioner's expert cite to Doud, as disclosing all other limitations in claim 19. Pet. 38-40; Ex. 1016 ¶¶47, 49.

As for [19b], Petitioner and its expert admit that a POSITA would understand Doud to support values of up to 35 wt. % of the additives. Pet. 22-24; Ex. 1016 ¶¶41-42. This means that Doud's written description fully supports claim 19 under §112.

Petitioner, however, incorrectly argues that there is "no literal support" for amounts above 35 wt.%. *Id.* That is not the law on written description, which does not require literal or *in haec verba* support in the written description of the entire open end of a range. *See Zai-Ming Qiu*, No. 2020-001512, 2020 WL 8185957, at *2; *Anderson*, 474 F.3d 1361; *Kirsch*, 498 F.2d, at 1394. "The subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) for the disclosure to satisfy the description requirement." MPEP §2163.02 (emphasis added). Because Petitioner and its expert admit that a POSITA would understand Doud's specification to support amounts up to 35 wt.%, Doud support 19[b] is as a matter of law. Therefore, Doud supports 19[b] and the remaining limitations in claim 19 as admitted by Petitioner.

Ironically, Petitioner's citation to *In re Wertheim* refutes its legally unsupported argument. The C.C.P.A. in *Wertheim* held the opposite of Petitioner's argument: "[i]f lack of literal support alone were enough to support a rejection under §112, then the [case precedent] ... that 'the invention claimed does not have to be described in *ipsis verbis* in order to satisfy the description requirement of §112,' [would be] empty verbiage." *Application of Wertheim*, 541 F.2d 257, 265 (C.C.P.A. 1976). That's exactly the point here: Doud's specification does not have to state in *ipsis verbis* an entire open-ended range to provide written description support, and the fact that Petitioner and expert admitted that Doud discloses to a POSITA amounts up to 35% means that Doud provides written disclosure for 19[b]. *Wertheim* does not stand for the proposition that an entire open-ended range must be supported in the written description.

The limitation of "at least .01 wt. %" has further support in at least ¶¶[0012]-[0030], [0032]-[0035], [0045]-[0047], [0051], [0053], [0057] of Doud as well as in claims 1, 16-22, 26-28 of Doud. For example, claim 1 of Doud recites an additive material having an upper end range of 45%. Again, a POSITA would understand what the upper end range would be based on Doud so that the open-ended recitation in [19b] does not constitute new matter.

Moreover, a POSITA reading the disclosures of Doud and the '740 patent would also understand the following statement: "[t]ypically, the magnesium or

magnesium alloy constitutes about 50.1-99.9 wt.%,” to understand that the weight percent of the additive material makes up the remaining amount. For example, taking the low end of the range for the magnesium or magnesium alloy (50.1 wt. %) lends, in an embodiment, to a high end range of the other components, such as the additive material, as: 49.9%, and the high end (99.9 wt. %) is the claimed low end (0.01 wt. %). As described, Doud, the ’653 patent, and the ’740 patent disclose the magnesium or magnesium alloy has constituting a *majority* of the dissolvable magnesium cast composite. Taken as a whole, the disclosure of Doud provides sufficient disclosures and teachings such that a POSITA is capable of determining the inherent upper limits of the open-end range of claim 19. *See Zai-Ming Qiu*, No. 2020-001512, 2020 WL 8185957, at *2.

This 50.1-99.9 wt.% teaching in Doud for magnesium or magnesium alloy also makes it evident to a POSITA the claimed additive material in claim 19 cannot constitute, for example, 50-100.0 wt. % of the dissolvable magnesium cast composite (because, at minimum, the dissolvable magnesium cast composite necessarily includes magnesium). Because a POSITA would not read a claim in a vacuum as alleged by Petitioner’s arguments, but rather read the specification to understand the scope of the open-ended range in claim 19, it is wrong for Petitioner to imply that that a POSITA could interpret the high end value could, in the abstract, being close to or at 100 wt. %. Petitioner’s argument violates the law because it

ignores what a POSITA would have done: read and understand the context of the rest of the claim language, the Doud specification, and understand the upper limit for the additive material. *Kirsch*, 498 F.2d at 1394.

Petitioner's own expert states that a POSITA would understand reading Doud what the upper limit or range for the additive material would be:

40. In claim 19, the concentration weight percentages for copper, nickel, and cobalt are recited as being "at least 0.01 wt% ... "

41. I have carefully reviewed the disclosure of the '653 patent. **The upper range boundary disclosed** for copper is 35 weight%. '653 patent col. 5 line 16. **The upper range** for nickel is 35 weight%. '653 patent col. 4 lines 58. **And the upper range** boundary for cobalt is 20 weight%. See '653 col. 5 line 41.

42. Further, the disclosure of the '653 patent discusses a more generic embodiment using secondary metal where the secondary metal may be copper, nickel, cobalt, titanium, silicon, or iron). See '653 patent col. 6 lines 15-20 and col. 8 lines 25-30. However, even here the secondary metal is disclosed as being below 35 weight%. See '653 patent col. 6 line 16.

Ex. 1016 ¶¶41-42 (emphasis added). Thus, a POSITA would have been able to discern, by his own admission, an "upper range boundary" for each of the one or more metals of copper, nickel, and cobalt, that were cited by the Petitioner as allegedly not having a "top end limitation." Ex. 1016 ¶¶41-42.

The expert's statements and the Petitioner's reliance on them demonstrate: (1) a POSITA would, in reviewing the disclosure of the '653 Patent, understand an upper end boundary of the "at least .01 wt. %." recitation in claim 19 as 35% and (2)

that this 35% boundary has written disclosure support in the '653 Patent. The expert continues:

43. The '653 patent does not disclose any values above 35 weight% for the copper, nickel, or cobalt.

44. So in my opinion, **to the extent that claim 19 covers** embodiments of a magnesium composite where the copper, nickel, or cobalt are present in **amounts over 35 weight %**, these embodiments are **not disclosed** in the disclosure of the '653 patent.

Ex. 1016 ¶¶43-44 (emphasis added).

The necessary corollary to the Declarant's opinion in ¶44, is that Doud fully supports claim 19 for values up to and including 35%, and that a POSITA would not use values above 35 wt. %, not that a POSITA wouldn't know what to do. The analogy would be the same as being asked to buy a gift for at least \$1. You have \$35 in your pocket. Thus, the logical (and legally required) conclusion is to buy a gift between \$1-\$35, not that you don't know how much you can spend as Petitioner argues. Dispositively, neither the Petitioner nor its expert demonstrate or argue that a POSITA would interpret or understand "at least .01 wt. %" in claim 19 to necessarily exceed 35%.

Petitioner has failed to meet its burden to show more likely than not that claim 19 is unpatentable and that there is not "an inherent, albeit not precisely known, upper limit and the specification enables one of skill in the art to approach that limit." In fact, Petitioner has done the opposite: Petitioner presented expert evidence and

evidentiary support in Doud itself that a POSITA can discern the upper limit. Petitioner's own argument is the reason to deny institution as a matter of law.

Since claim 19 is supported by Doud, claim 19 is entitled to the benefit of the priority date of its earliest-filed parent application, i.e., Doud. Therefore, the Doud is not prior art to claim 19 and cannot serve to anticipate claim 19 as relied on by the Petitioner. The Board should deny institution for claim 19.

2. Petitioner does not allege, and therefore failed to prove, any dependent claims lack written description support in Doud.

Claims 20-61 and 63-81 depend from claim 19. Petitioner did not argue that those claims recite limitations that are not supported by Doud, but the opposite: Doud discloses what is recited in all of those dependent claims. Pet. 40-45.

The Petitioner alone bears the burden of proof to demonstrate in the Petition that each and every challenged claim is unpatentable, and that burden **never** shifts to the patentee. *See* 35 U.S.C. §316(e); *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016) (citing *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015)). To prevail in its challenges to the claims, Petitioner must prove unpatentability by a preponderance of the evidence, i.e., the petitioner must prove that the claims are more likely than not unpatentable. 35 U.S.C. §316(e); 37 C.F.R. §42.1(d). Moreover, Petitioner must identify, with particularity, each claim challenged, the grounds on which each challenge to each claim is based, and the evidence supporting each ground. 35 U.S.C. §312(a)(3).

Petitioner does not identify any dependent claim lacking written description support in Doud. Pet. 22-24. Instead, Petitioner presents claim 19 and its dependents as a singular group allegedly lacking written description support for the same limitations of “at least .01 wt. %” pertaining to the one or more metals selected from the group consisting of copper, nickel, and cobalt, which is recited in claim 19. *Id.* Petitioner did not identify a single instance where Doud does not support the dependent claims as written. Therefore, Doud is also a properly cited priority application, not prior art, to those dependent claims. 35 U.S.C. §120.

Since IPR should not be instituted for claim 19, IPR should also not be instituted for its dependent claims.

3. Claims 76-81 recite upper range limits supported by Doud for all of the metals.

To further end all doubt regarding Doud’s §112 support, dependent claims 76-81 also recite upper limits for the ranges in claim 19 that are fully supported by Doud, which is the sole basis for Petitioner’s Ground I position. This supports the fact that claim 19 itself can have upper limits as much as or higher than those in claims 76-81 that are supported by the written description in Doud as stated in Section V(A)(1), *supra*. Thus, because Doud on its face supports these (and other) upper limits, Petitioner fails to prove lack of written description support. The Board should not institute IPR on this additional evidentiary basis.

Petitioner does not make any specific lack of written description arguments for the claims depending from claim 19. Pet. 22-24. Petitioner, however, incorrectly argues that the upper limits for the ranges recited in 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. The table below compares the relevant limitations:

Claim 19	Claims 76-81
...an additive material, <u>said additive material includes</u> 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...	...wherein <u>said additive material includes</u> 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.

Petitioner attempts to argue that because the ranges of claim 76 “could be satisfied by a dissolvable magnesium composite which includes copper at 1% by weight and cobalt at 22% by weight” where even though “the cobalt falls outside of the cited range of 0.1-20 wt. %,” the copper “in the range of 0.1-35 wt.% thereby meet[s] the limitation,” that this shows that the *claims 76-81 “do not require the ranges for each enumerated metal if present.” Id.* (emphasis added). This is not remotely compelling for proving the Petitioner’s limited claim construction, however, because

for one, the Petitioner cites absolutely no support to justify its argument and two, this is simply how a Markush group works. *See* MPEP §2117.

That is, Markush groups are, by definition, a list of alternatives. MPEP §2117; *In re Harnisch*, 631 F.2d 716, 719-20 (CCPA 1980); *Ex parte Markush*, 1925 Dec. Comm'r Pat. 126, 127 (1924). A Markush group is a listing of specified alternatives of a group in a patent claim, typically expressed in the form: a member selected from the group consisting of A, B, and C. *Abbott Lab'ys v. Baxter Pharm. Prod., Inc.*, 334 F.3d 1274, 1280 (Fed. Cir. 2003). It is well known that “members of the Markush group are ... alternatively usable for the purposes of the invention.” *Id.* citing *In re Driscoll*, 562 F.2d 1245, 1249 (CCPA 1977). Thus, “members of the Markush group are used singly.” *Id.* citing *Meeting Held to Promote Uniform Practice In Chemical Divisions*, 28 J. Pat. & Trademark Off. Soc'y 849, 852 (1946).

Here, the recitations in claims 76-81 specifically relate to “said additive material,” which has antecedent basis in claim 19. In all claims 19 and 76-81, the claims recite that “said additive material includes one or more metal materials selected from the group consisting of...” The Petitioner attempts to argue that the three wt. % ranges for copper, nickel, and cobalt, in claims 76-81 should not be read to limit each of the corresponding three wt. % ranges for copper, nickel, and cobalt in claim 19. But even if the three wt. % ranges for copper, nickel, and cobalt in claims 76-81 **did** limit all of the three wt. % ranges for copper, nickel, and cobalt in

claim 19, contrary to the Petitioner's claim construction, the Petitioner's example of support proving its claim construction would still fall within the scope of the claim. For example, if the only wt. % ranges for copper, nickel, and cobalt were "0.1-35 wt. % copper, 0.1-24.5 wt. % nickel and 0.1-20 wt. % cobalt" as recited in claims 76-81, then this would still be satisfied by "a dissolvable magnesium composite which includes copper at 1% by weight and cobalt at 22% by weight" because only one limitation has to be satisfied in a Markush group. Petitioner's argument that this example of support proves that the claims 76-81 "should not be construed to limit all of the ranges of copper, nickel, and cobalt recited in claim 19" is nonsensical.

Claims 76-81 recite ranges for the "said additive material includ[ing] one or more metals selected from the group consisting of..." that further narrow the corresponding ranges in claim 19. Moreover, the ranges in claims 76-81 include upper boundaries of 35 wt. %, 24.5 wt. %, and 20 wt. % for copper, nickel, and cobalt, respectively. These upper boundaries are supported in the disclosure of Doud because, at minimum, both the Petitioner and the Petitioner's expert admit that ranges up to 35% are "literally" supported by Doud. Pet. 22-24; Ex. 1016 ¶¶41-42.

Because claims 76-81 include an upper boundary for the ranges that fall within the ranges admitted by the Petitioner and its expert as supported in Doud, and the upper boundary is the basis Petitioner argues is not supported in claim 19 by Doud,

Petitioner has not met – and cannot meet –its burden to prove unpatentability. The Board should not institute IPR on Ground I.

B. Gound II—the Remaining Claims are not obvious over Xu.

Claims 1-18 and 62 are disclaimed. Claims 19-61 and 63-81 are not remotely obvious to a POSITA based on Xu. The burden of proof for obviousness is on Petitioner, and that burden never shifts. *Magnum Oil*. 829 F.3d at 1375.

Obviousness is a question of law. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). However, whether a reference teaches away is a question of fact, and a reference that teaches away “preclude a determination that the reference renders a claim obvious.” *In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012).

During examination, “claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art.” *In re Am. Academy of Science Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004) (quoting *In re Bond*, 910 F.2d 831, 833 (Fed. Cir. 1990)).

This is not a close call. Xu (which identifies chemical engineers from Baker Hughes, a large oil company, as inventors) teaches a powder compact, not the dissolvable magnesium cast composite of claim 19. Ex. 1007, 59. In fact, Xu explicitly teaches away from metal alloys “formed by, e.g., casting from a melt” for its powder formulations. *Id.* Therefore, Xu does not teach a POSITA (or anyone understanding metallurgy for that matter) claim limitations [19pre], [19b], [19d], or

[19e] or make it obvious that to use the powder formulations using a unique cellular nanomatrix in Xu for making cast alloys as that melt would literally melt away that nanomatrix in Xu.

Dispositively, Petitioner fails to address the fact that Xu in paragraph 59 flatly teaches a POSITA not to make cast alloys with its formulations. It is implausible to conclude what Petitioner has: a POSITA with a fraction of the skill of Xu and his colleagues at Baker Hughes would read Xu and do the opposite of what Xu says. Not only that, but that POSITA would do something completely different from Xu in a way that just so happens to be recited in claim 19.

As set forth below, Petitioner's implausible argument is not evidence carrying the burden to show obviousness; it is impermissible hindsight of trying to use keyword searches of words out of claim 19 and shoehorn Xu into it. It would not have been obvious to a POSITA to perform the opposite of what Xu teaches and the Board should reject Petitioner's invitation to an obvious error.

1. Xu teaches away from the magnesium cast composite in [19pre] and [19b]

Petitioner alleges that “Xu '185 [0031] discloses a magnesium alloy and [0028], and [0054] discloses the metal composite is dissolvable, and [0059] a cast material is taught.” Pet. 55.

Petitioner ignores the elephant in the room: claim 19 repeatedly recites a “dissolvable magnesium cast composite” in both [19pre] and [19b]. In fact, [19b] recites that cast limitation three times in the body of claim 19.

Xu instead teaches a powder compact metal composite having a cellular nanomatrix and a metal matrix. Ex. 1007 ¶31. The composite is formed from a combination of powder constituents. *Id.* at 41. “These powder constituents can be selected and configured for compaction and sintering [not melting a cast] to provide the metal composite.” *Id.* Furthermore, “when compacted and sintered” the metal nanomatrix forms a “cellular nanomatrix” coating material disposed on the metal matrix powder. *Id.* at 49. The term “cellular nanomatrix” describes “the extensive, regular, continuous and interconnected nature of the distribution of nanomatrix material” within the metal composite. *Id.* at ¶44.

Because Xu teaches a POSITA that to compact and sinter the powder to form that cellular nanomatrix, *it teaches a POSITA against a cast composite:* “[m]oreover, 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 as the metal composites herein.” *Id.* at 59.

Incredibly, Petitioner’s analysis of claim 19 does not cite to ¶59 of Xu which teaches a POSITA not to cast from a melt. Pet. 55-56. Instead, Petitioner makes the

improperly biased and empty “routine experimentation” attorney argument without any scientific or engineering explanation or evidence that a POSITA would have tried to form a composite by casting from a melt, when Xu and his fellow inventors explicitly stated it would not work. *Id.* at 46-47. Because Xu explicitly stated that forming a composite by casting a melt will “not have the selectively tailorable material and chemical properties as the metal composites herein”, and because Petitioner ignored that evidence to argue the contrary without evidence, Petitioner’s obviousness argument against claim 19 based on Xu fails.

Therefore, because Xu teaches a POSITA a powder configured for compaction and sintering to form a desirable cellular nanomatrix that has “selectively tailorable material and chemical properties as the metal composites herein”, Xu teaches away from the magnesium cast composite in [19pre] and [19b]. As such, it would not have been obvious to a POSITA to apply the teachings of Xu to form the cast composite recited in claim 19. The Board should deny institution of Ground II based on this first, independent basis.

2. Xu does not teach the “in situ precipitate having a size of no more than 50 μm ” in [19d]

[19d] teaches a relatively small size for the claimed in situ particles of no more than 50 μm . Petitioner alleges that Xu ¶38 teaches this limitation. Pet. 55. However, Xu ¶38 teaches the size of the additive particle, which is not remotely comparable with the in situ particles in [19d]. As a powder compact, Xu teaches away from the

in situ particles which requires having a molten magnesium composite. '740 patent, 4:10-13. Xu ¶39 teaches the size of the metal matrix that is dispersed throughout the cellular nanomatrix, which although is not the in situ particles is more comparable.

However, Xu ¶39 merely teaches 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. Ex. 1007 ¶39. There are three reasons this paragraph does not teach [19d]. First, most of that incredibly broad range in Xu is much larger than 50 µm, which is the opposite of what claim 19 requires. Second, Xu provides no teaching of what ranges perform what desirable functions (e.g., does an 800 µm particle exhibit better properties than a 500 nm particle?). Third, Petitioner yet again ignores the entirety of what ¶39 states: the “particles” referred to in that paragraph refer to the “metal matrix 214” particles which magnesium or aluminum (*see* Xu ¶32 (“metal matrix 214 can include... aluminum [and] magnesium...”)) – *not* in situ particles from cobalt, copper or nickel as recited in [19d].

Simply put, ¶39 in Xu teaches different particles with different sizes than the in situ precipitate particles of no more than 50 µm in [19d]. Therefore, the Board should deny institution of Ground II on this second, independent basis.

3. Xu does not teach the dissolution rate based on the conditions (in 3 wt. % KCl water mixture at 90° C) recited in [19e].

[19e] identifies a very clear solution, temperature and dissolution rate based on that solution and temperature: the cast composite dissolves at a rate of at least 5 mg/cm²/hr in 3 wt. % KCl water mixture at 90° C.

Xu does not teach these three limitations (solution, temperature, and dissolution rate) together to a POSITA as required in [19e]. Petitioner cites to Xu ¶¶52, 54, which teaches literally hundreds of thousands of possibilities for solutions, temperatures and dissolution rates – but not the specific solution, temperature or dissolution rate together as recited in claim 19.

For the solution, Xu teaches literally dozens of different potential salts or acids to dissolve the powder composite. Ex. 1007 ¶¶52, 53. In fact, Xu teaches a POSITA away from the solution in claim 19 stating to a POSITA the desirability of “*increas[ing]* the density of the brine, such as 10.6 pounds per gallon of CaCl₂ brine.” *Id.* at ¶52. Using what Xu teaches, a POSITA would understand that to mean using a dense **56 wt. %** CaCl₂ water mixture. Petitioner and its expert provide no explanation – let alone the necessary motivation evidence required by the law to establish obviousness – of how it would have been obvious to a POSITA to read that 56 wt. % teaching in Xu for CaCl₂ and use 3 wt. % KCl.

Once again, Petitioner ignores the evidence teaching against obviousness in paragraph 53 of Xu, which teaches a POSITA not to use a salt but rather an acid to

dissolve that powder composite. Petitioner gives no explanation whatsoever on why a POSITA would have been motivated based on reading Xu to use a salt over an acid listed in Xu, to pick KCl out of all the salts listed, and to use only 3% KCl, when Xu teaches using much higher weight percentages to increase the density of the brine. Petitioner did not and cannot establish obviousness based on these contrary teachings to a POSITA.

Likewise, Petitioner does not address the fact that Xu teaches a POSITA to use incredibly high dissolution temperatures of 800°, 1000°, or 1200° F (427°, 537°, or 649° C), to achieve dissolution rates of 50-500 mg/cm²-hr. Pet. 55-56. Petitioner makes the incorrect conclusory attorney argument that “[b]ecause the disclosed ranges overlap and/or embrace the range and/or values in the ’740 patent *the POSA would consider them obvious as overlapping ranges or through routine optimization.*” Pet. 56. Xu ¶52 teaches that the metal composite have a temperature rating up to about 1200° F, specifically up to about 1000° F, and more specifically about 800° F. Xu '185 does not teach a temperature of 90° C (or 194° F), which is significantly less than 800° F. That unsupported argument is not evidence of teaching a POSITA to use 90° C to achieve the claimed dissolution rate.

The same lack of teaching or motivation also goes to the dissolution rate itself. Xu ¶54 teaches an incredibly broad dissolution rate of 1 mg/cm²/hr to about 10,000 mg/cm²/hr. That range, however, is completely dependent on the composite, the

dissolving agent used, and the temperature. Petitioner, its expert, and Xu do not explain what factors cause a dissolution rate of 1-5, greater than 5, greater than 100, greater than 1,000, or up to 10,000 per that range. A POSITA would not have been taught or motivated to use the dissolution rate with the conditions set forth in [19e] based on the incredibly broad teachings in Xu. Therefore, this is a third independent basis to deny institution of Ground II.

C. Ground III only challenges claim 1, which has been disclaimed.

Ground III should be denied because it only challenges claim 1, which has been disclaimed. *See, infra*, §§ II.F. & III.

D. Ground IV—the Remaining Claims are not obvious over Xiao in view of Xu.

Claims 1-18 and 62 are disclaimed. Claims 19-61 and 63-81 are not obvious over Xiao in view of Xu. The combination of Xiao and Xu does not teach claim limitations [19pre], [19b], [19c], or [19d].

1. The USPTO already determined that Xiao does not teach [19b] or [19c]

In reexamination, the USPTO already determined that Xiao does not disclose in situ precipitates formed from copper, nickel, and/or cobalt:

Xiao is the closest prior art and it fails to teach a magnesium alloy that includes 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 materials required by the claims. There is no suggestion from Xiao [sic] to substitute

copper, nickel, iron, or cobalt for the aluminum in the galvanically-active intermetallic.

Ex. 1009, 4.

Xiao teaches away from galvanically-active in situ precipitates and does not teach galvanically-active phases or intermetallic particles. Ex. 2018 ¶37. As discussed above, Xu teaches away from a cast composite. Therefore Xiao and Xu should be precluded from rendering claim 19 obvious, and the combination of Xiao and Xu cannot teach the dissolvable magnesium cast composite of claim 19.

Petitioner alleges that Xiao ¶62 teaches “Ni values are 5, 0.1, 2.5, 5, 0.05, 1, and 0.1 % by weight” and that “Cu values are 2.5, 5, 0.05, 1, and 0.1 % by weight.” Pet. 72.

Xiao ¶¶60-62 teaches an Al-Ni intermediate alloy and an Al-Cu intermediate alloy and seven examples with each example having Ni at 5, 0.1, 2.5, 2.0, 0.05, 0.8, 1.5, and 1 wt. % and Cu at 0, 0, 2.5, 5, 0.05, 1, and 0.1 wt. %. Xiao teaches that the additives are intermediate alloys with aluminum, which is not the same as the Markush group in [19b]. Ex. 2025, at 25; Ex. 2018 ¶¶42-43. Therefore, Xiao does not teach claim limitation [19b].

Petitioner alleges that Xiao ¶26 teaches that “elements such as Fe, Cu, Ni, Ag owing to defining a large amount of intermetallic microparticle, can improve the corrosive nature of the magnesium alloy.” Pet. 72.

Xiao ¶26 teaches “Elements such as Fe, Cu, Ni, Ag, etc., in the magnesium alloy can form a large number of intermetallic composite micro-particles, which can improve the corrosion performance of the magnesium alloy, thereby promoting the decomposition of the magnesium alloy.” There are no other teachings in Xiao regarding intermetallic composite micro-particles or intermetallic particles. Ex. 2025, at 23.

Xiao “adopts a magnesium alloy with a high aluminum content (13 to 25% by weight)..., in which the purpose of adding the high content of aluminum content is 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, and the magnesium matrix a phase functions as an anode phase, so 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.” Ex. 1006 ¶26.

“In requiring the eutectically formed $\text{Mg}_{17}\text{Al}_{12}$ – Mg micro-batteries, Xiao *teaches away* from the claims... which requires 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 elemental secondary metal additives” Ex. 2018 ¶37. The USPTO agreed in reexamination. Ex. 1009, 4.

This is supported in the '740 patent at column 4 lines 10-13 which states, “The never melted additives(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.” Therefore, the Board should deny Ground IV on this first, independent basis.

2. Neither Xiao nor Xu teach in situ particles having a size of no more than 50 μm in [19d].

Petitioner correctly admits that “Xiao ‘271 does not disclose this limitation” recited in [19d]. Xiao does not teach to a POSITA any size for any particle, let alone the benefit of specific size ranges. Once again, Petitioner did not identify or address this contrary POSITA evidence to the Board. Dr. Nava miscites in his declaration at ¶75 that Xiao discloses size range of 100nm to 1000 μm , but that is incorrect because Xiao does not disclose any particle size. Therefore, Xiao in no way discloses, teaches or suggests this recited size range in [19d].

Xu merely teaches a POSITA an incredibly broad range of sizes for the metal matrix, i.e., the magnesium ranging from as small as 50nm all the way up to 800 μm . Ex. 1007, ¶38-39. There are two reasons Xu does not teach [19d]. First, most of that incredibly broad range in Xu is much larger than 50 μm , which is the opposite of what claim 19 requires. Second, Xu provides no teaching of what ranges perform what desirable functions (e.g., does an 800 μm particle exhibit better properties than a 500nm particle?).

Xu again, of course, teaches a POSITA away from a cast composite, as set forth in Section V.B.1, above. This means that a POSITA would NOT be motivated to do what Xu or Xiao teaches and combine them in a way that just so happens to read on claim 19. Petitioner's argument is not an obviousness argument, it is a hindsight biased argument prohibited by law. *Ecolchem, Inc. v. Southern California Edison Co.*, 227 F.3d 1361, 1371 (Fed. Cir. 2000). Indeed, Petitioner and its expert failed to address, let alone present any evidence whatsoever, on how a POSITA reading Xu that teaches away from using cast composites, would use its teachings with Xiao for cast composites. The Board should deny institution of Ground IV on this second, independent basis.

VI. CONCLUSION

Based on the foregoing reasons, the Board should not institute the aforementioned Petition.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that this response was served to lead and back-up counsel for Petitioner by e-mail on June 5, 2023, as follows:

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CERTIFICATE OF COMPLIANCE

Patent Owner, Terves, LLC, certifies the following:

1. This brief complies with the type-volume limitation of 37 C.F.R. §42.24(a)(2). Specifically, this brief contains 12,597 words, excluding parts of the brief exempted by 37 C.F.R. §42.24(a)(1), according the word count function of Microsoft Word; and

2. This brief complies with the typeface requirements of 37 C.F.R. §42.6(a)(2)(ii) and the type style requirements of 37 C.F.R. §42.6(a)(2)(iii). Specifically, this brief has been prepared in a proportionally spaced typeface using Microsoft Word in a 14 point Times New Roman font.

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