

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HENGDIAN GROUP DMEGC MAGNETICS CO., LTD.,
ZHEJIANG INNUOVO MAGNETICS CO., LTD., and
ZHEJIANG DONGYANG EAST MAGNETIC RARE EARTH CO., LTD.,
Petitioners,

v.

HITACHI METALS, LTD.,
Patent Owner.

Case IPR2017-01312
Patent 6,461,565 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and
CHRISTOPHER M. KAISER, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

We have jurisdiction to conduct this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that claims 1–12 of U.S. Patent No. 6,461,565 B2 (“the ’565 patent,” Ex. 1001) are unpatentable.

A. *Procedural History*

Hengdian Group DMEGC Magnetics Co., Ltd., Zhejiang Innuovo Magnetics Co., Ltd., and Zhejiang Dongyang East Magnetic Rare Earth Co., Ltd. (collectively, “Petitioner”) filed a Petition (“Pet.”) to institute an *inter partes* review of claims 1–12 of the ’565 patent. Paper 2. Hitachi Metals, Ltd. (“Patent Owner”) filed a Preliminary Response (“Prelim. Resp.”). Paper 6. Pursuant to 35 U.S.C. § 314(a), we instituted an *inter partes* review based on the following grounds: (1) whether claims 1, 2, 6, and 8–12 are unpatentable under 35 U.S.C. § 103 as obvious over the combined teachings of Zhou¹ and Young;² (2) whether claims 3–5 are unpatentable under 35 U.S.C. § 103 as obvious over the combined teachings of Zhou, Young, Yamamoto,³ and Kaneko;⁴ and (3) whether claim 7 is unpatentable under 35 U.S.C. § 103 as obvious over the combined teachings of Zhou, Young,

¹ *Effect of Environmental Retention Time of NdFeB Magnetic Particles on Structure and Properties of Sintered Magnet*, 24 JOURNAL OF MAGNETIC MATERIALS AND DEVICES, Vol. 24, No. 2 (1993) 1–4, 53 (Ex. 1017). We refer to “Zhou” as the English translation of the original reference.

² U.S. 5,093,076, issued March 3, 1992 (Ex. 1008).

³ U.S. 5,383,978, issued Jan. 24, 1996 (Ex. 1004).

⁴ U.S. 5,666,635, issued Sept. 9, 1997 (Ex. 1005).

Yamamoto, and Ota.⁵ Paper 7 (“Dec. on Inst.” or “Institution Decision”), 22. Pursuant to the holding in *SAS Inst., Inc. v. Iancu*, 138 S.Ct. 1348, 1355–57 (2018), we subsequently modified our Institution Decision to include all of the challenged claims and all of the grounds presented in the Petition, namely, the following additional grounds:

Reference(s)	Basis	Challenged Claim(s)
Ren ⁶	§ 102	1, 2, 6, and 8
Ren	§ 103	1, 2, 6, and 8
Ren and Yamamoto	§ 103	3
Ren and Kaneko	§ 103	5
Ren, Yamamoto, and Kaneko	§ 103	4
Ren and Kohara ⁷	§ 103	9–12
Ren, Yamamoto, and Ota	§ 103	7

Paper 24, 2 (“[W]e modify our institution decision to institute on all of the challenged claims and all of the grounds presented in the Petition.”); see Pet. 7–8.

After institution of trial, Patent Owner filed a Patent Owner Response (“PO Resp.,” Paper 18) and a Supplemental Patent Owner Response (“Supp. PO Resp.,” Paper 29). Petitioner filed a Corrected Reply (“Pet. Reply,” Paper 27) and a Supplemental Reply (“Supp. Pet. Reply,” Paper 30). Petitioner relies on the Declaration of John Ormerod, Ph.D. (“Ormerod Declaration,” Ex. 1010). Patent Owner relies on the Declaration of Dr. Peter Moran (“Moran Declaration,” Ex. 2014). Petitioner filed a Motion to

⁵ Japanese Unexamined Patent App. Pub. No. S65-33505, published Dec. 13, 1998 (Ex. 1006). We refer to “Ota” as the English translation of the original document.

⁶ U.S. 6,261,515 B1, issued July 17, 2001 (Ex. 1003).

⁷ U.S. 6,299,832 B1, issued Oct. 9, 2001 (Ex. 1007).

Exclude Exhibits 2007–2011 and 2014. Paper 33. Patent Owner filed an Opposition (Paper 35), and Petitioner filed a Reply (Paper 36).

An oral hearing was held on August 6, 2018, and a transcript is included in the record. Paper 40 (“Tr.”).

B. Related Proceedings

The parties indicate that the ’565 patent was asserted by Patent Owner before the International Trade Commission in *In the Matter of Certain Sintered Rare Earth Magnets, Methods of Making Same and Products Containing Same*, Investigation No. 337-TA-855. Pet. 2; Paper 4, 2. Patent Owner also identifies two additional *inter partes* reviews of related patents: IPR2014-01265 (challenging U.S. Patent No. 6,537,385) and IPR2014-01266 (challenging U.S. Patent No. 6,491,765). Paper 4, 2–3.⁸

C. The ’565 Patent

The ’565 patent, titled “Method of Pressing Rare Earth Alloy Magnetic Powder,” generally relates to a method of making a green compact of a rare earth alloy magnetic powder. Ex. 1001, 1:6–7. The ’565 patent explains that “if a magnetic powder of a rapidly solidified alloy (e.g., a strip cast alloy, typically) is compacted by a known pressing technique, the as-pressed, green compact has a potential to generate sufficient heat for

⁸ In its Mandatory Notices, Patent Owner indicated that IPR2014-01265 and IPR2014-01266 were “currently on appeal.” Paper 4, 2–3. On July 6, 2017, the U.S. Court of Appeals for the Federal Circuit issued an opinion affirming the Board’s decision in IPR2014-01265, and vacating-in-part and remanding for further consideration the Board’s decision in IPR2014-01266. *Hitachi Metals, Ltd. v. Alliance of Rare-Earth Permanent Magnet Industry*, Nos. 2016-1824, 2016-1825 (Fed. Cir. July 6, 2017); see *Hitachi Metals, Ltd. v. Alliance of Rare-Earth Permanent Magnet Industry*, Case IPR2014-01266 (PTAB Feb. 11, 2018) (Paper 45) (Board’s Decision on Remand from the Federal Circuit).

combustion, depending on the particular state of the environment.” *Id.* at 2:5–10. According to the ’565 patent, although “[i]t is possible to suppress oxidation of the rare earth alloy powder by carrying out the pressing and compacting process within an inert gas environment,” doing so is neither cost-effective nor practical because placing the press entirely within “an inert gas environment requires a[] large amount of inert gas,” and, in order to check the process, “the worker must either bring his own supply of oxygen, or he must replace the inert gas environment with a breathable environment.” *Id.* at 2:30–46.

The ’565 patent teaches suppressing this heat-generating reaction “by controlling both the temperature and humidity of the environment to appropriate ranges during the pressing process, facilitating safe and consistent production of rare earth alloy magnet[s] with superior magnetic properties.” *Id.* at 4:45–50. In particular, in order to avoid condensation that may lead to combustion, “the environment preferably has a temperature controlled at 15° C. or more and a relative humidity controlled at less than 90%.” *Id.* at 9:54–57. Because static electricity is likely to accumulate and create spark discharge that increases the risk of combustion “when the relative humidity of the environment decreases to less than 40%,” “from safety considerations, the relative humidity of the air environment is preferably controlled at 40% or more.” *Id.* at 9:57–63.

Based on the results of experiments reported in the ’565 patent, “the air environment most preferably has a temperature controlled to the range from 15° C. through 25° C. and a relative humidity controlled to the range from 40% through 55%.” *Id.* at 9:34–67. Additionally, “[i]f the environment temperature minus the dew point exceeds 15° C., then the

relative humidity is sometimes less than 40%,” so “the environment temperature minus the dew point is preferably 15° C. or less.” *Id.* at 10:2–8. Because “the environment for the pressing/compacting process is the air, not an inert gas,” “the temperature and humidity of the environment can be controlled using a normal air conditioner.” *Id.* at 10:9–12. According to the ’565 patent, “there is no problem if some part of a spacious pressing chamber has a temperature higher than 30° C. or a relative humidity exceeding 65%” as long as “each part being pressed and every part that might increase the risk of heat generation or combustion of as-pressed compacts should have its temperature and humidity controlled to the predetermined ranges.” *Id.* at 10:30–36.

Claims 1 and 2 are the challenged independent claims, and are reproduced below.

1. A method of forming a green compact of a rare earth alloy magnetic powder comprising the steps of:
providing a rare earth alloy powder,
providing a controlled environment having a temperature ranging from 5° C. to 30° C. and a relative humidity ranging from 40% to 65%, and
pressing the rare earth alloy powder within the controlled environment.
2. A method of forming a green compact of a rare earth alloy magnetic powder comprising the steps of:
providing a rare earth alloy powder,
providing a controlled environment having a temperature ranging from 5° C. to 30° C. and a relative humidity ranging from 40% to 65%, and a dew point of at least 6° C. less than the temperature, and
pressing the rare earth alloy powder within the controlled environment.

Ex. 1001, 11:2–19.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner contends that a person having ordinary skill in the art at the time of the '565 patent would have had “a bachelor’s degree in materials science, metallurgical engineering, or physics and two to four years of work or research experience in the field of rare-earth magnets,” or a master’s degree in the same fields and one to two years of experience relating to rare-earth magnets. Pet. 7 (citing Ex. 1010 ¶ 16).

Patent Owner does not dispute Petitioner’s assessment in its Response. Patent Owner’s declarant Dr. Moran, however, provides his own assessment regarding a person of ordinary skill in the art at the time of the '565 patent. Ex. 2014 ¶ 51. Dr. Moran opines that a person having ordinary skill in the art would have had an advanced degree “in materials science, physics, or a related field and have two or more years of experience developing or studying the fabrication of rare earth magnets using techniques such as powder fabrication, rapid solidification, powder consolidation, or the engineering of microstructures in rare earth magnet materials to enhance magnet performance.” *Id.*

We do not observe meaningful differences between the parties’ assessment of a person having ordinary skill in the art. We further note that both assessments appear consistent with the level of ordinary skill in the art at the time of the invention as reflected in the prior art in this proceeding. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is

not shown” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))). Our determination regarding the patentability of the challenged claims does not turn on the differences between these definitions. We adopt Petitioner’s assessment, but note that our conclusions would be the same under Dr. Moran’s assessment.

B. Claim Interpretation

We interpret claims of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent in which [the claims] appear[.]” 37 C.F.R. § 42.100(b) (May 2, 2016); see *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016).⁹ Consistent with the broadest reasonable construction, claim terms are presumed to have their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. See *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

⁹ The revised claim construction standard for interpreting claims in *inter partes* review proceedings as set forth in the final rule published October 11, 2018 does not apply to this proceeding, because the new “rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date.” Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (to be codified at 37 C.F.R. pt. 42).

For purposes of the Institution Decision, we construed “controlled environment” as set forth in independent claims 1 and 2 to mean “an air environment in which one or more conditions are controlled.” Dec. on Inst. 10. The parties do not contest our construction of the term “controlled environment” (see PO Resp. 3; Pet. Reply 1; Supp. PO Resp. 3–5; Supp. Pet. Reply 2), and we see no reason to modify that construction in light of the record developed at trial.

C. *Principles of Law*

To prevail on its challenges to the patentability of the claims, a petitioner must establish facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). “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) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. See *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378–79 (Fed. Cir. 2015) (discussing the burdens of persuasion and production in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations,

including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). Although the elements must be arranged in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e., identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990).

D. Overview of the Prior Art

1. Zhou

Zhou describes a study investigating “the effect of the retention time of Nd_{16.5}Fe₇₆B_{7.5} magnetic particles at 20°C and 50% relative humidity (RH) as well as 30°C and 100% RH on the microstructure and magnetic properties of sintered magnet.” Ex. 1017, 1. Zhou concludes that, when the magnetic particles “were placed in the atmosphere at 20° C and 50% RH for 48 hours, the magnetic properties of the sintered magnet were not significantly degraded,” but when “magnetic particles with the same composition were placed in the atmosphere at 30°C and 100% RH for a short period of time, for example two hours, the coercive force of the sintered magnet significantly decreased.” *Id.* at 4–5. According to Zhou, “[o]xidation of magnetic particles became more severe with the increase in the

environmental retention time,” and “was especially severe at a high environment temperature and high relative humidity.” *Id.* at 5.

2. *Young*

Young relates to the hot pressing and subsequent hot working of rare earth element-containing powder alloys, and, more particularly, “to the hot pressing of such materials using open air presses.” Ex. 1008, 1:4–8. Young describes compacting the powder material “to a green compact at ambient temperature and in air,” which Young refers to as “cold pressing.” *Id.* at 3:4–8. Young teaches that “[t]he cold pressed compact suitably has a density of about five grams per cubic centimeter or higher” and is formed, “in part, to somewhat reduce the particle surface exposed to oxidation and to improve heat transfer to the mass.” *Id.* at 3:8–13. A film of solid die lubricant is formed on the die wall of the press as part of the cold pressing operation, but “[n]o lubricant or binder is mixed with the rare earth element-containing powder because the material is quite reactive and chemical change degrades magnetic properties.” *Id.* at 3:14–19.

Young teaches that, following the cold pressing operation, the green compact is “hot worked in another open air press.” *Id.* at 3:38–39. According to Young, one advantage of the described process “is that both compaction steps can be carried out on open-to-the-air presses.” *Id.* at 4:45–47.

3. *Yamamoto*

Yamamoto is directed to “an alloy ingot for permanent magnet of rare earth metal-iron or rare earth metal-iron-boron having a crystalline structure excellent in magnetic properties, anisotropic permanent magnet powders of rare earth metal-iron-boron, a method for producing the ingot or powders,

and a rare earth metal-iron permanent magnet.” Ex. 1004, 1:8–14.

Yamamoto describes a method of producing an alloy ingot in which “the rare earth metal-iron alloy in the molten state is allowed to be uniformly solidified under the cooling conditions of the cooling rate of 10° to 1000° C./sec., preferably 100° to 1000° C./sec., and the sub-cooling degree of 10° to 500° C. and preferably 200° to 500° C.” *Id.* at 4:19–25. The alloy ingot “may be produced by a strip casting method consisting in melting the rare earth metal-iron alloy or a rare earth metal-iron-boron alloy in an inert gas atmosphere.” *Id.* at 4:41–45. Yamamoto also describes forming alloy ingots into permanent magnets “by the conventional process steps of pulverization, mixing, comminution, compression in the magnetic field and sintering.” *Id.* at 5:14–18.

4. *Kaneko*

Kaneko relates “to fabrication methods for high-performance R–Fe–B permanent magnets with excellent crystal orientation.” Ex. 1005, 1:7–9.

Kaneko describes a method “wherein cast alloys or ground alloys, obtained by ingot grinding, Ca reduction diffusion or strip casting, are coarse ground by mechanical grinding or a H_2 absorption decay method,” and the “coarse powders or the raw material powders are compounded with a solid type or a liquid type lubricant and then fine ground by a jet mill.” *Id.* at 3:25–31.

Kaneko states that this method “enables the production of powders with good flowability and a[] uniform particle distribution together with a reduction in the particle size of the main phase crystallites which constitute the alloy ingot.” *Id.* at 3:31–34. According to Kaneko, when “the powders have been compounded with a particular lubricant, the fabrication efficiency

is greatly improved due to an approximately twofold increase in the fine grinding efficiency.” *Id.* at 3:38–41.

Kaneko describes an embodiment where cast alloys “are fabricated by the strip casting method,” and “[t]he obtained cast alloy is a thin plate with a thickness of 0.03 mm~10 mm.” *Id.* at 3:54–58. Kaneko teaches that “[t]he cross-sectional structure of the R–Fe–B alloy of a particular composition obtained by” this strip casting method “has main phase $R_2Fe_{14}B$ crystals less than one tenth the size of those in ingots obtained by conventional casting.” *Id.* at 4:4–8. For example, Kaneko explains, “fine crystals with a short axis dimension of 0.1 μm ~50 μm and a long axis dimension of 5 μm ~200 μm are obtained, and the R-rich phase which surrounds these main phase crystals will also be finely distributed.” *Id.* at 4:8–12.

5. *Ota*

Ota is directed “to a method for manufacturing raw material powder for Fe-B-R-based permanent magnet material and, in particular, to a method for manufacturing raw material powder for Fe-B-R-based permanent magnet material that is stable, safe to handle and can be press-compacted in atmosphere.” Ex. 1006, 21.¹⁰ In particular, Ota provides “a method for manufacturing raw material powder that improves the jet mill pulverization method so that more stable fine powder that can be press-compacted in atmosphere is produced, pressing efficiency is improved, drop in product quality is prevented and Fe-R-B-based permanent magnet material with excellent magnetic properties” is produced. *Id.* at 22. Ota teaches that the starting material for the manufacturing process “is obtained by high-

¹⁰ The pages number in Ex. 1006 refer to the document’s original pagination set forth in the bottom-center of the page.

frequency induction melting of rare-earth metal, electrolytic iron, ferroboron alloy and optionally electrolytic Co and casting the molten metal to obtain an ingot.” *Id.* at 23. A coarsely pulverized powder is obtained by fracturing the ingot and coarsely pulverizing “by spontaneous disintegration caused by H₂ absorption.” *Id.*

The coarsely pulverized powder, having an average grain size of 10–500 µm, is introduced into a jet mill, where “[s]upersonic inert gas containing 50 to 60,000 ppm of O₂” “injects the coarsely pulverized powder” into the pulverizing chamber of the jet mill. *Id.* The coarsely pulverized material is then “finely pulverized by collision between the raw material powder and the supersonic inert gas, by collision between powder particles, and by collision and friction between the powder and the pulverizing chamber walls.” *Id.* Ota states that the fine powder that results from the jet mill pulverization process has “an average grain size of 1.5 to 5 µm.” *Id.*

6. *Ren*

Ren relates to “a method for producing rare-earth magnets that have improved magnetic properties.” Ex. 1003, 1:18–20. Ren explains that oxidation of the rare-earth element in the magnet “is seriously destructive to the properties of rare earth-containing magnets,” and, “[a]ccordingly, there is a need for a cost-effective method for manufacturing rare earth containing magnets that consistently reduces and/or controls the ability of oxygen-containing sources to react with the magnetic powder during the manufacture of the rare earth containing magnet.” *Id.* at 1:45–48, 1:60–64.

The method Ren describes generally entails (1) isolating the magnetic powder from oxygen containing sources, (2) forming and molding the

magnetic powder in an isolated environment in which the relative humidity level can be adjustably reduced and maintained below 40% and the oxygen content below 1%, and (3) aligning and compressing the magnetic body while it is isolated from oxygen-containing sources. *Id.* at 8:15–24. Ren teaches that the isolation of magnetic powders from oxygen-containing sources “is accomplished by packing the magnetic powder into individually-wrapped packages and vacuum sealing the packages.” *Id.* at 8:65–9:1. The individually-wrapped, vacuum-sealed packages are then placed into an isolated environment, into which a flow of inert gas is activated in order to “purge[] humidity and/or oxygen from the isolated environment.” *Id.* at 9:16–20. While in the isolated environment, the magnetic powder is transferred to mold bases and compressed within the mold bases by mold covers. *Id.* at 9:25–30. The molded magnetic powder then undergoes a magnetic alignment procedure, during which it is further compressed to equalize the magnetic alignment, subsequently forming the magnetic body (also known as a green compact). *Id.* at 9:33–41.

7. *Kohara*

Kohara is directed “to a process for supplying a rare earth metal-based alloy powder to a cavity in a mold, for example, in order to subject the rare earth metal-based alloy powder to a pressing for producing a rare earth metal-based magnet, and to an apparatus suitable for use in such process.” Ex. 1007, 1:8–12. Kohara Figure 2 is reproduced below.

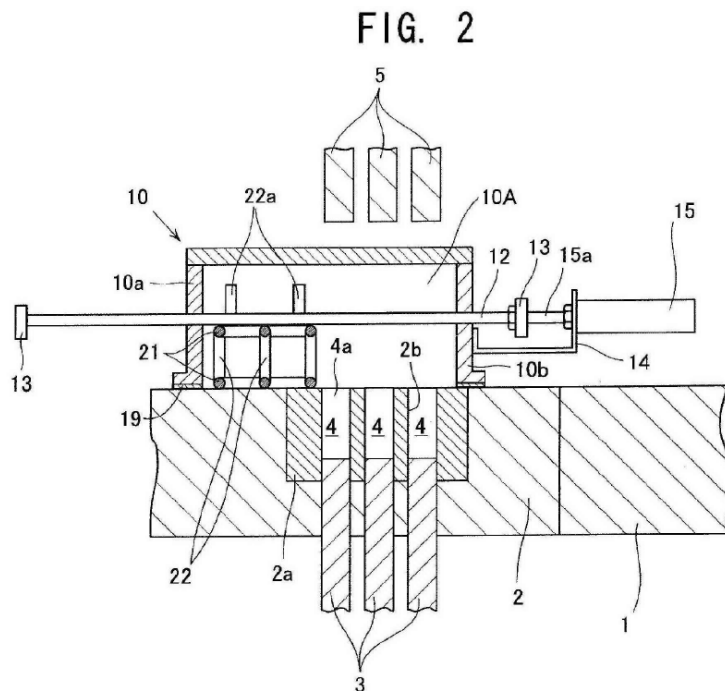


Figure 2 is a side sectional view of a portion of one embodiment of the pressing system equipped with a powder supplying apparatus described by Kohara. *Id.* at 6:57–59. Die 2a is fitted in die set 2 disposed adjacent to base plate 1, with die hole 2b provided vertically therethrough. *Id.* at 8:15–18. Lower punch 3 is disposed such that it can be fitted into die hole 2b from below. *Id.* at 8:18–19. Cavity 4 is defined by an inner peripheral surface of die hole 2b and an upper end face of lower punch 3. *Id.* at 8:19–21. An alloy powder is supplied into cavity 4 by feeder box 10. *Id.* at 8:22–24. Upper punch 5 is inserted into cavity 4 to compress the alloy powder by cooperation with lower punch 3, forming a green compact of the alloy powder. *Id.* at 8:25–28.

E. Obviousness over Zhou and Young

Petitioner contends that claims 1, 2, 6, and 8–12 are unpatentable under 35 U.S.C. § 103 as obvious over the combined teachings of Zhou and Young. Pet. 42–56; Pet. Reply 1–14, 18–20. Petitioner relies on the

Ormerod Declaration in support of its contentions. *Id.* Patent Owner disagrees with Petitioner’s assertions, and relies on the Moran Declaration. PO Resp. 4–35, 42–44.

Petitioner argues that, in view of Zhou’s teaching of controlling the temperature and relative humidity of the air during retention of the magnetic particles, “which appl[ies] to the environment of the pressing step,” a person having ordinary skill in the art (“POSA”) “would have been motivated to conduct pressing in a controlled environment of 20°C and 50% relative humidity to avoid degradation of the magnet properties.” Pet. 47 (citing Ex. 1017, 2; Ex. 1010 ¶ 164). Petitioner also argues that, “in view of Young’s teaching of pressing in ambient temperature and air” and “a POSA’s awareness that pressing in open air was generally known and convenient,” a “POSA would have been motivated to conduct the pressing step in open air.” *Id.* (citing Ex. 1008, 3:4–10; Ex. 1006, 22–23; Ex. 1010 ¶¶ 26–27, 164).

Petitioner’s arguments are premised on its contention that the experiments described in Zhou were performed in an air environment. Patent Owner disputes this contention, and asserts that Zhou’s retention time experiments were conducted in a nitrogen atmosphere. See PO Resp. 1, 4–22. As an initial matter, we note that Zhou does not explicitly describe whether the environment of its retention tests is air or nitrogen. Instead, Zhou repeatedly states that the magnetic particles being studied were placed in “the atmosphere,” with no other qualifier except to specify the temperature and relative humidity. See, e.g., Ex. 1017, 1 (“magnetic particles were placed in the atmosphere at 20°C and 50% relative humidity (RH)” and “at 30°C and 100% RH for 48 hours”), (“magnetic particles were

respectively placed in atmospheres with different temperatures and different humidity levels for different lengths of time”), 2 (“Figure 3 and Figure 4 respectively show the effect of retention time of magnetic particles placed in the atmosphere at 30°C and 100% RH on the magnetic properties and demagnetization curve of the sintered magnet.”), 4 (when the magnetic particles “were placed in the atmosphere at 20°C and 50% RH for 48 hours, the magnetic properties of the sintered magnet were not significantly degraded.”).

To support its contention that Zhou “unmistakably relates to experiments on the effects of temperature and humidity in an air atmosphere, not nitrogen,” Petitioner asserts that “Zhou describes the test atmospheres by temperature and relative humidity, noting that ‘[s]uch an atmosphere is equivalent to the climate of South China,’” and that “the atmosphere of South China is not an inert gas environment.” Pet. Reply 5–6 (quoting Ex. 1017, 2–3; citing Ex. 2006, 76:5–8). Petitioner also asserts that “Patent Owner’s argument that Zhou’s controlled test environment is nitrogen is contrary to the plain meaning of ‘atmosphere,’” and that “a POSA would understand the term ‘atmosphere,’ without any indication of additional gas, to be an air atmosphere as used in common parlance.” *Id.* at 6 (citing Ex. 1030, 3). Petitioner relies on the dictionary definition of “atmosphere” as “the gaseous envelope surrounding the earth; the air” as evidence of a POSA’s understanding of the term “atmosphere.” Ex. 1030, 3.

We are not persuaded that Zhou’s use of the word “atmosphere” establishes that Zhou’s controlled test environment is an air environment. Although Dr. Ormerod refers to Zhou’s statement that an atmosphere of 30° C and 100% relative humidity is equivalent to the climate of South

China as one basis for his belief that Zhou's tests were conducted in an air atmosphere, he goes on to testify that Zhou's use of the word "climate" in that instance relates to the temperatures and relative humidities of the region. Ex. 2006, 75:12–77:2; *see also id.* at 77:3–6 ("Q: So you think that the reference to climate in that sentence refers to the conditions of temperature and relative humidity? A: That are typical in that region, yes."). That understanding of "climate" is consistent with Dr. Moran's testimony that

Zhou's statement that the experimental environment of sample 3 "is equivalent to the climate of South China" does not imply an experimental air environment. Instead, a person of ordinary skill in the art reading this statement of Zhou would understand that the reference to "climate" is merely a reference to the specific temperature and relative humidity conditions of South China. Not that South China has air.

Ex. 2014 ¶ 84 (emphasis omitted). At best, the evidence of record establishes that the temperature and relative humidity conditions of Zhou's test atmosphere are modeled on the climate, namely, the temperature and relative humidity, of South China. It does not establish whether that test atmosphere was air or nitrogen.

Moreover, in addition to defining "atmosphere" as "the gaseous envelope surrounding the earth; the air," the dictionary provided by Petitioner also includes definitions for use in specific disciplines. Ex. 1030, 3. When using "atmosphere" in the context of chemistry, "atmosphere" is defined as "any gaseous envelope or medium." *Id.* Neither Petitioner nor Dr. Ormerod explains why a POSA would understand Zhou's use of "atmosphere" to refer specifically to the air in earth's atmosphere, and not generally to a gaseous envelope or medium as it would be understood in chemistry. In this regard, we credit Dr. Moran's testimony that the word

“atmosphere” on its own does not automatically mean “air.” During the magnet manufacturing process, it is common to use various inert (e.g., nitrogen) atmospheres. For example, the jet milling of rare earth powder takes place in a jet mill chamber having a nitrogen atmosphere and the finely milled powder is collected and sealed in a container having a nitrogen atmosphere.

Ex. 2014 ¶ 83. Applying the chemical definition of “atmosphere” (namely, a gaseous envelope or medium) to its use in Zhou does not provide any information as to whether the atmosphere of Zhou is air, nitrogen, or some other gaseous environment.

We also find Patent Owner’s argument that “[d]uring a typical magnet manufacturing process at the time of the invention (and well before), the rare earth alloy powder production process and subsequent storage were conducted in an inert (e.g., nitrogen) environment” to be supported by the evidence of record. PO Resp. 8 (citing Ex. 2014 ¶¶ 73–76). The parties do not dispute that it was well known that magnetic powder was known to spontaneously combust because rare earth elements (e.g., neodymium) are reactive, easily oxidizable, and produce a flammable powder. Ex. 1010 ¶ 25; Ex. 2014 ¶ 73. The parties also do not dispute that oxidation was known to reduce the coercive effect of sintered magnets, and that oxidation was a particular problem after fine pulverization and through the pressing step. Ex. 1010 ¶ 26; Ex. 2014 ¶ 74.

In that regard, Dr. Moran testifies that, in order to avoid the risks associated with oxidation, “rare earth powder was typically handled and stored in an inert (e.g., nitrogen) or vacuum environment in order to minimize exposure of the rare earth powder to oxygen sources (e.g., O₂ or H₂O).” Ex. 2014 ¶ 76. Dr. Ormerod similarly testifies that (1) after coarse

pulverization, the “coarse material would be collected in some sort of vessel” that typically included an inert gas or nitrogen environment (Ex. 2006, 12:12–13:14); (2) after fine pulverization, the powder is collected “in a vessel, which can be filled with an inert gas, including nitrogen, and then sealed” (*id.* at 17:10–17); and (3) at the time of the ’565 patent, magnet manufacturers typically sealed finely pulverized in a vessel having an inert environment to reduce oxidation and combustion risks (*id.* at 25:3–13). The method described in Ren is consistent with Dr. Moran’s and Dr. Ormerod’s testimony. Specifically, Ren describes vacuum-packing magnetic particles into sealed packages and forming and molding the magnetic powder in an isolated inert gas environment, and further describes magnetically aligning the formed magnet and compressing the formed magnet while the formed magnet “is isolated from direct contact with the surrounding environment.” Ex. 1003, 2:28–39, 2:48–54.

Petitioner further argues that a “POSA would understand that Zhou is not testing in a nitrogen environment because a nitrogen environment at 100% relative humidity would have been an impractical environment to simulate.” Pet. Reply 8. This argument, however, is contradicted by the disclosures in Ren. In particular, Ren reports the results of tests conducted on magnets produced in an inert environment with between 40% and 90% relative humidity. Ex. 1003, 4:60–5:63, Tables 3–5. Ren also recognizes that “[p]umping an inert gas, such as nitrogen, into a sealed environment is an effective means for reducing the oxygen content from in the surrounding environment, but this does not reduce or eliminate H₂O from the surrounding environmental humidity.” *Id.* at 7:54–58. Dr. Moran explains that this statement in Ren

is consistent with how one of ordinary skill in the art would understand vapor pressure. Specifically, a person of ordinary skill in the art would understand that for a given water vapor content in a gas, the relative humidity would be the same whether the gas is inert (e.g., nitrogen) or air, all other things being equal.

Ex. 2014 ¶ 87. Accordingly, that Zhou conducted experiments at 100% relative humidity does not establish that the test atmosphere was air, nor does it establish that the test atmosphere was nitrogen.

Petitioner also argues that a “POSA would also not expect the oxygen content of Zhou’s powders to increase by the amount observed if the powders were tested using an inert gas atmosphere.” Pet. Reply 6.

Petitioner relies on Zhou’s finding that “the oxygen content in the magnet[s] roughly doubled after powdering, pressing and sintering,” and that “Zhou concluded that 50 to 60% of the oxygen was introduced in the powdering, pressing, and sintering step.” *Id.* (quoting Ex. 1017, 4). Petitioner also points to Dr. Ormerod’s testimony that one reason he believes Zhou’s samples 2 and 3 were in an air environment is because, “particularly with sample 2, that there is some oxygen pickup from the .71 value to .96. So that suggests there’s -- there’s oxygen present.” Ex. 2006, 79:4–13.

Neither Petitioner nor Dr. Ormerod, however, address whether the relative humidity of Zhou’s retention environment could create the identified oxygen increase. After noting that “almost 50 to 60% of the oxygen in the magnet was introduced during powdering, pressing and sintering,” Zhou goes on to explain:

The data in Table 1 show that the oxygen content in the magnet increased with the increase in the retention time of magnetic particles, and the oxidation of the magnetic particles was especially severe at a high environmental temperature and high

relative humidity. Oxidation changed the composition and microstructure of the magnet, leading to a drastic degradation of the properties of the magnet.

Ex. 1017, 3. Zhou, therefore, appears to attribute the change in oxygen content to the combination of high temperature and high relative humidity, conditions which are achievable in both air and inert atmospheres. In that regard, we credit Dr. Moran's un rebutted testimony that a

person of ordinary skill in the art would know that humidity is nothing more than water molecules in gas, and that water readily oxidizes rare earth powder by itself, in the absence of oxygen or air. Specifically, water vapor (H_2O) can react with rare earth alloy powder to form hydrides and hydroxides. These hydroxides serve as a source of oxygen which in turn oxidize the rare earth powders. In fact, at the temperature discussed in *Zhou*, rare earth powders can be oxidized much faster by water vapor resulting from high humidity rather than by elemental oxygen in air. (Ex. 1001 at 4:34–40; Ex. 1003 at 5:55–63). Because water vapor (i.e., humidity) can readily oxidize rare earth powder, a person of ordinary skill in the art would know that humidity alone is capable of producing the oxygen increase shown in *Zhou's* Example 2.

Ex. 2014 ¶ 89. Consequently, we are not persuaded that the oxygen increase shown in *Zhou's* samples 2 and 3 demonstrates that *Zhou's* test atmosphere was air, as Petitioner contends.

After considering the parties' arguments and evidence, we determine that *Zhou* is unclear as to whether its test atmosphere is an air or inert environment. Much of the evidence, as described above, could support either interpretation. It is Petitioner's burden, however, to establish facts supporting its challenge that claims 1, 2, 6, and 8–12 would have been obvious over the combined teachings of *Zhou* and *Young* by a preponderance of the evidence. 35 U.S.C. § 316(e); see also *Harmonic*, 815

F.3d at 1363 (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). “Failure to prove the matter as required by the applicable standards means that the party with the burden of persuasion loses on that point—thus, if the fact trier of the issue is left uncertain, the party with the burden loses.” *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1327 (Fed. Cir. 2008). Because Petitioner’s argument that a POSA would have been motivated to apply the environmental conditions of Zhou’s retention step to Young’s open-to-the-air pressing step is based on its contention that Zhou’s test atmosphere was air, and because Petitioner has not established that Zhou’s test atmosphere was air, we are not persuaded that Petitioner has made a sufficient showing that a POSA would have combined the teachings of Zhou and Young in the manner proposed.

Accordingly, we find that Petitioner has not shown by a preponderance of the evidence that claims 1, 2, 6, and 8–12 of the ’565 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combined teachings of Zhou and Young.

F. Remaining Obviousness Grounds Based on Zhou and Young

Petitioner contends that (1) claims 3–5 would have been obvious over the combined teachings of Zhou, Young, Yamamoto, and Kaneko and (2) that claim 7 would have been obvious over the combined teachings of Zhou, Young, Yamamoto, and Ota. Pet. 56–62. Claims 3–5 and 7 depend, directly or indirectly, from independent claims 1 and 2. As set forth above, Petitioner has not shown by a preponderance of the evidence that independent claims 1 and 2 would have been obvious over the combined

teachings of Zhou and Young. *See supra* II.E. For the same reasons, Petitioner has not established by a preponderance of the evidence that claims 3–5 would have been obvious over the combined teachings of Zhou, Young, Yamamoto, and Kaneko, or that claim 7 would have been obvious over the combined teachings of Zhou, Young, Yamamoto, and Ota.

G. Anticipation by Ren

Petitioner contends that claims 1, 2, 6, and 8 are unpatentable under 35 U.S.C. § 102 as anticipated by Ren. Pet. 8–17. Patent Owner disagrees with Petitioner’s assertions. Supp. PO Resp. 11–13.

Petitioner asserts, with supporting testimony from Dr. Ormerod, that Ren teaches all of the elements of independent claims 1 and 2. Pet. 9–16. For example, Petitioner asserts that Ren discloses “providing a controlled environment having a temperature ranging from 5° C. to 30° C. and a relative humidity ranging from 40% to 65%” because “Tables 3–5 of Ren show[] several examples with controlled temperature range and controlled humidity that are within” the claimed ranges. *Id.* at 11–12 (citing Ex. 1010 ¶¶ 44–46). Dr. Ormerod testifies that “[a]n example is shown in the middle column of Table 3 that has a controlled environment with a temperature of 20° C and relative humidity of 55%,” which “are within the 5°C to 30°C temperature range and the 40% to 65% relative humidity range as required by Claim 1.” Ex. 1010 ¶ 46. Dr. Ormerod also identifies “the right most column in Table 5” as “show[ing] a temperature of 30°C and relative humidity of 40%, which are both inside the ranges as required by Claim 1.” *Id.*; *see also id.* ¶ 51 (“Claim 2 recites similar limitations as claim 1 so I incorporate the analysis of Claim 1 into the analysis of Claim 2.”).

Patent Owner responds that Ren's "singular focus is on forming and molding the rare earth powder in an inert gas environment," because Ren states that "[d]ue to its chemical nature, a rare earth element such as neodymium is very easily oxidized" and "the magnetic powders must be isolated from direct contact with the surrounding environment to prevent oxidation." Supp. PO Resp. 12 (quoting Ex. 1003, 4:11–12, 8:60–62; citing Ex. 1003, 10:40–55). Patent Owner also points to Ren's description of "forming and molding the magnetic powder in an isolated environment wherein the humidity level within the isolated environment is maintained consistently below 40% and the oxygen content is maintained below 1%." *Id.* at 13 (quoting Ex. 1003, 2:32–34) (emphasis omitted). Because "the typical oxygen content of air in Earth's atmosphere is about 21%," Patent Owner argues that Ren's "isolated environment for forming and molding the magnetic powder cannot be an air environment as it does not have enough oxygen." *Id.* (citing Ex. 2003).

We agree with Patent Owner. As set forth above, we interpreted "controlled environment" to mean "an air environment in which one or more conditions are controlled." *See supra* Section II.B. Ren discloses controlling the conditions of an isolated, inert gas environment. *See, e.g.*, Ex. 1003, 2:48–54 ("The isolated environment generally comprises . . . means for supplying inert gas into the enclosure and desiccating agents disposed between the inert gas supply means and the enclosure, along with desiccating agents within the enclosure."), 7:53–57 ("Pumping an inert gas, such as nitrogen, into a sealed environment is an effective means for reducing the oxygen content from in [*sic*] the surrounding environment, but this does not reduce or eliminate H₂O from the surrounding environmental

humidity.”), 9:16–20 (“After placing the individually-wrapped packages of magnetic powder into the isolated environment, a flow of inert gas” into the isolated environment is activated, and “[t]he inert gas purges humidity and/or oxygen from the isolated environment.”). Consequently, we are not persuaded that Petitioner has established that Ren teaches “providing a controlled environment having a temperature ranging from 5° C. to 30° C. and a relative humidity ranging from 40% to 65%” as recited in independent claims 1 and 2.

Therefore, based on our review of the record, we find that Petitioner has not established by a preponderance of the evidence that claims 1 and 2, and claims 6 and 8 that depend directly therefrom, are anticipated by Ren.

H. Obviousness over Ren

Petitioner argues that Ren would have rendered the subject matter of 1, 2, 6, and 8 obvious to a POSA. Pet. 18–25; Pet. Supp. Reply 3–8. Petitioner relies on the Ormerod Declaration in support of its contentions. *Id.* In particular, Petitioner argues that “a POSA would have been motivated to control the temperature and relative humidity within the range that was shown to be good in Ren, which happens to fall within the claimed range of the ’565 patent” because Ren teaches that samples exposed to 55% relative humidity and 20°C temperature had better performance characteristics than samples exposed to 85% relative humidity and 30°C temperature. Pet. 18–19 (citing Ex. 1010 ¶ 80). Petitioner argues that “as Ren recognizes, the use of inert gas ‘does not reduce or eliminate H₂O from the surrounding environmental humidity’” and, therefore, “a POSA would still have been motivated to control relative humidity and temperature.” *Id.* at 21 (quoting Ex. 1003, 7:54–58). Petitioner further argues that it would have been

obvious to try compressing magnetic powders without an inert gas because the only options are compressing with inert gas or without inert gas, and “[c]ompressing magnetic powders without inert gas was known, thus such an option would be evident to a POSA.” *Id.*

Patent Owner contends that Ren “explicitly teaches forming and molding the magnetic powder in an environment with an ‘oxygen content [] maintained below 1%,” and replacing Ren’s “inert gas with air is the opposite of minimizing and maintaining the oxygen content of the pressing environment below 1%.” Supp. PO Resp. 14 (quoting Ex. 1003, 2:34–35) (emphasis omitted). Patent Owner also contends that Dr. Ormerod “admits that ‘Ren discloses “compressing steps” where the rare earth magnetic powder is compressed in an environment that minimizes and controls the humidity level and the oxygen content.’” *Id.* (quoting Ex. 1010 ¶ 81) (emphases omitted).

Petitioner responds that “pressing in an open air environment was well-known at the time of the invention,” and a POSA “would have recognized that an open-air pressing environment is a common alternative to an inert-gas environment.” Supp. Pet. Reply 3–4 (citing Pet. 21). Petitioner further argues that a POSA “would have understood that Ren’s teaching that oxidation can be reduced by controlling temperature and humidity would hold true in either an inert gas or open air environment.” *Id.* at 4 (citing Pet. 21). Petitioner also relies on Dr. Ormerod’s testimony that, in view of Ren’s disclosure, a POSA “would have known that in an open-air environment humidity would still cause rare earth powder to oxidize and should therefore be controlled,” and concludes that a POSA “would know to control temperature and humidity even if the press were in open air, and thus

would be motivated to do so to minimize oxidation.” *Id.* at 5 (citing Ex. 2006, 177:3–11).

Based on our review of the record, we are not persuaded that Petitioner has established sufficiently that a POSA would have modified Ren to omit the use of an inert gas environment. As an initial matter, Petitioner’s arguments that the proposed modification “would have been obvious or obvious to try” are largely conclusory. *See* Pet. 20–21. An obvious-to-try rationale generally requires some identification of “a design need or market pressure to solve a problem” before looking at the “finite number of identified, predictable solutions.” *KSR*, 550 U.S. at 421. Neither Petitioner nor Dr. Ormerod provide such an analysis. In that regard, Dr. Ormerod only opines that “it would have been obvious for a POSA to use a controlled environment that either includes inert gas or does not include inert gas, because Ren teaches that the addition of inert gas ‘does not reduce or eliminate H₂O from the surrounding environmental humidity,’” ““and compressing powders without using inert gas was known.”” Ex. 1010 ¶ 81 (quoting Ex. 1003, 7:54–58; citing Ex. 1018, 3:6–9, 3:33–36; Ex. 1008, 3:3–6). This appears to be nothing more than a statement that a POSA could have made the proposed modification.

Obviousness, however, “concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (citing *InTouch Techs., Inc. v. VGO Commc’ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)). Petitioner’s contentions and Dr. Ormerod’s opinions say no more than that a POSA could have compressed magnetic powders without using an inert gas.

We similarly are unpersuaded by Petitioner's argument that a POSA "would be motivated by Ren's disclosure to use temperature and humidity to control oxidation in an inert gas or open-air environment." Supp. Pet. Reply 5–6; *see* Pet. 18–22. In that regard, Petitioner points to Ren's teaching that "'consistently maintaining the relative humidity below approximately 40%' reduces oxygen and produces superior rare earth magnets." Pet. 21 (citing Ex. 1003, 3:61–4:2). Dr. Ormerod testifies that "Ren's method specifically focuses on the relative humidity and temperature of the controlled environment," and that "Ren teaches a POSA that '[a]s a result of reducing the humidity level . . . oxidation of the magnetic powders and green compacts is minimized, and the magnetic properties of the rare earth magnet are substantially improved.'" Ex. 1010 ¶ 82 (quoting Ex. 1003, 2:54–60). Therefore, according to Dr. Ormerod, "a POSA would have been motivated to control the relative humidity and temperature." *Id.*

Petitioner and Dr. Ormerod, however, do not address Ren's teaching that the combination of reducing humidity levels below 40% and maintaining oxygen content below 1% improves the magnetic properties of the rare earth magnet. In that regard, Ren states:

The method for producing rare earth magnets according to the present invention generally comprises the steps of vacuum-packing magnetic powder into sealed packages, forming and molding the magnetic powder in an isolated environment wherein the humidity level within the isolated environment is maintained consistently below 40% *and the oxygen content is maintained below 1%*, aligning magnetically the formed magnet while the formed magnet is isolated from direct contact with the surrounding environment and compressing the formed magnet while the formed magnet is isolated from direct contact with the surrounding environment.

Ex. 1003, 2:28–39 (emphasis added). Ren further teaches that:

The method for producing a rare earth-containing magnet having high magnetic properties, in accordance with the present invention, generally comprises the steps of (1) isolating the magnetic powder from oxygen containing sources, (2) forming and molding the magnetic powder in *an isolated environment within which the relative humidity level can be adjustably reduced and maintained below 40% and the oxygen content below 1%*, and (3) aligning and compressing the magnetic body while the magnetic body is isolated from oxygen-containing sources.

Id. at 8:15–24 (emphasis added). Ren concludes that controlling both the humidity level and the oxygen content is essential to providing rare earth magnets with improved properties:

As a result of reducing the humidity level and oxygen content throughout the forming and molding step, and isolating the green compact from the surrounding environment during magnetic alignment and compression, oxidation of the magnetic powders and green compacts is minimized, and the magnetic properties of the rare earth magnet are substantially improved, such that the maximum energy product $((BH)_m)$ is increased by at least 3–5 MGOe and the intrinsic coercivity (H_{ci}) is increased by at least 2–4 KOe and the working temperature is increased approximately 30° C. to 50° C.

Id. at 2:54–64 (emphasis added); *see also id.* at 3:4–7 (“Another object of the invention is to provide a method for producing rare earth-containing magnets that minimizes and controls the humidity level and oxygen content of the manufacturing environment during forming and molding.”)

Moreover, in arguing that Tables 3–5 of Ren disclose “[a] successful embodiment of the temperature and humidity ranges of” claim 1 of the ’565 patent, Petitioner and Dr. Ormerod again focus on Ren’s disclosure regarding the effect of controlling humidity without regard to Ren’s teachings regarding oxygen content. Pet. 18–19, 21–22. In particular,

Petitioner and Dr. Ormerod argue that “Ren’s tables and disclosure regarding humidity would have provided a POSA with a reasonable expectation of success, particular[ly] where Ren teaches that ‘consistently maintaining the relative humidity below approximately 40%’ reduces oxygen and produces superior rare earth magnets.” *Id.* at 21 (quoting Ex. 3:61–4:2); Ex. 1010 ¶ 83. Ren, however, attributes the production of superior rare earth magnets to “consistently maintaining the relative humidity below approximately 40% *and the oxygen content below 1%* during the forming and molding of the magnetic powder.” Ex. 1003, 3:61–4:2 (emphasis added). Ren’s Tables 3–5 “show the performance characteristics of rare earth-containing magnets manufactured using the invention,” which includes maintaining the oxygen content below 1% and the relative humidity below approximately 40%. *Id.* at 4:60–62.

In light of these disclosures in Ren, neither Petitioner nor Dr. Ormerod explains sufficiently why a POSA would have used Ren’s method in the open air. Ren repeatedly emphasizes that the superior properties of the rare earth magnets it describes are a result of maintaining the isolated environment of the forming and molding step at a relative humidity of below approximately 40% and an oxygen content below 1%. Petitioner’s arguments and Dr. Ormerod’s testimony with respect to the modification of Ren leave an analytical gap that does not sufficiently apprise us of why one of ordinary skill in the art would have modified Ren’s process by performing that step in the open air, without controlling the environment of the forming and molding step to an oxygen content below 1%. Petitioner’s and Dr. Ormerod’s assertions that a POSA would be motivated by Ren to improve the magnet properties by controlling relative humidity

and temperature do not adequately address why a POSA would have reasonably expected that the magnetic properties would still be improved if the oxygen content of the environment were not maintained below 1%. See Pet. 18–22; Ex. 1010 ¶¶ 75–83.

After considering the parties’ arguments and evidence, we are not persuaded that Petitioner has made a sufficient showing that a person having ordinary skill in the art would have modified the teachings of Ren in the manner proposed by Petitioner. Accordingly, we find that Petitioner has not shown by a preponderance of the evidence that independent claims 1 and 2 of the ’565 patent, and claims 6 and 8 that depend directly therefrom, would have been obvious over Ren.

I. Remaining Obviousness Grounds Based on Ren

Petitioner contends that: (1) the subject matter of claim 3 would have been obvious over the combined teachings of Ren and Yamamoto; (2) the subject matter of claim 5 would have been obvious over the combined teachings of Ren and Kaneko; (3) the subject matter of claim 4 would have been obvious over the combined teachings of Ren, Yamamoto, and Kaneko; (4) the subject matter of claims 9–12 would have been obvious over the combined teachings of Ren and Kohara; and (5) the subject matter of claim 7 would have been obvious over the combined teachings of Ren, Yamamoto, and Ota. Pet. 25–42. Claims 3–5, 7, and 9–12 depend, directly or indirectly, from independent claims 1 and 2. To support its contention that the identified combinations otherwise teach or suggest all of the limitations of claims 3–5, 7, and 9–12, Petitioner relies on the disclosures and arguments with respect to Petitioner’s contention that Ren anticipates and/or renders obvious independent claims 1 and 2. See Pet. 26, 28, 34.

As set forth above, we determine that Petitioner has not established by a preponderance of the evidence that independent claims 1 and 2 of the '565 patent are anticipated or rendered obvious by Ren. *See supra* Sections II.G, II.H. For the same reasons, Petitioner has not established by a preponderance of the evidence that claims 3–5, 7, and 9–12 would have been obvious over the combined teachings of Ren and/or Yamamoto, Kaneko, Kohara, and/or Ota.

III. PETITIONER'S MOTION TO EXCLUDE

Petitioner moves to exclude Exhibits 2007–2011 and paragraphs 78–80 of the Moran Declaration (Ex. 2014), which rely on Exhibits 2007–2011. Paper 33, 1–6. We do not consider the merits of Petitioner's Motion to Exclude with respect to these exhibits because our Decision does not rely on Exhibits 2007–2011 or paragraphs 78–80 of the Moran Declaration.

Petitioner also moves to exclude the Moran Declaration in its entirety because, according to Petitioner, Dr. Moran fails “to tie his experience to the relevant time frame,” and, therefore, “his testimony is speculative in nature and not based on sufficient facts nor based on a reliable foundation.” Paper 33, 7. Specifically, Petitioner argues that Dr. Moran's work “on rare earth magnets during the 2010–2013 timeframe” does not “qualify him as a person of ordinary skill in the art at the time of the invention—the early 2000s.” *Id.* at 6. Petitioner argues that Dr. Moran does not provide any basis “as to why his far more recent experience qualifies him to speak on the state of the art and the thought process of a person of ordinary skill in the early 2000s.” *Id.*

Federal Rule of Evidence 702 (“FRE 702”) provides that a witness qualified as an expert by knowledge, skill, training, or education may testify

in the form of an opinion if (a) the expert's knowledge will help the trier of fact to understand the evidence or to determine a fact in issue, (b) the testimony is based upon sufficient facts or data, (c) the testimony is the product of reliable principles and methods, and (d) the witness has applied the principles and methods reliably to the facts of the case. Testimony on the issue of unpatentability proffered by a witness who is not "qualified in the pertinent art" generally is not admissible under FRE 702. *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1363–64 (Fed. Cir. 2008). In determining who is qualified in the pertinent art under FRE 702, we need not find a complete overlap between the witness's technical qualifications and the problem confronting the inventor or the field of the endeavor. *See SEB S.A. v. Montgomery Ward & Co., Inc.*, 594 F.3d 1360, 1372–73 (Fed. Cir. 2010) (upholding admission of the testimony of an expert who admittedly lacked expertise in the design of the patented invention, but had experience with materials selected for use in the invention).

To testify as an expert under FRE 702, a person need not be a person of ordinary skill in the art, but rather "qualified in the pertinent art." *Sundance*, 550 F.3d at 1363–64; *SEB*, 594 F.3d at 1372–73. The '565 patent states that "[t]he present invention relates to a method of making a green compact of a rare earth alloy magnetic powder and a method of producing a rare earth permanent magnet." Ex. 1001, 1:6–8. Dr. Moran's qualifications, as summarized in his curriculum vitae (Ex. 2014, App'x A), qualify him to give expert testimony on the subject of producing rare earth permanent magnets. He possess a Bachelor of Science degree in physics, and a Master of Science degree and Ph.D. in materials science, and testifies that, while he was an Associate Professor at Michigan Technological University, he "spent

three years synthesizing and researching rare earth permanent magnets, specifically $\text{Nd}_2\text{Fe}_{14}\text{B}$ -based magnets, and their methods of manufacture. This research included developing rapid solidification processes to make $\text{Nd}_2\text{Fe}_{14}\text{B}$ -based powders, processes to hydrogen decrepitate and mechanically mill the powders, and processes to consolidate the powders into rare earth magnets.” Ex. 2014 ¶¶ 2–4. Dr. Moran also testifies that, in the course of this research, he “strip-cast and melt-spun rare earth magnet alloys, prepared powders of rare earth magnet alloys with hydrogen decrepitation and with ball milling techniques, and consolidated these powders into green compacts and fully dense magnets using cold-pressing, sintering, and hot-pressing,” and conducted experiments “that magnetically aligned rare earth magnet powders” made from ingot cast and strip-cast alloys, and those “made from melt-spun material using hot deformation.” *Id.* ¶ 2.

Accordingly, we determine that Dr. Moran has the “knowledge, skill, experience, training, [and] education” in the pertinent art, namely, producing rare earth permanent magnets, to qualify him as an expert witness in this proceeding pursuant to FRE 702. Moreover, to the extent that Dr. Moran’s testimony is unsupported or speculative in nature, we weigh Dr. Moran’s testimony accordingly, taking into account the extent of his expertise. *See, e.g., Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010) (holding the Board has discretion to give more weight to one item of evidence over another “unless no reasonable trier of fact could have done so”); *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) (“[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the

declarations.”). Under these circumstances, we decline to exclude the Moran Declaration.

For these reasons, we deny Petitioner’s Motion to Exclude with respect to Ex. 2014.

IV. CONCLUSION

After reviewing the record and weighing the evidence offered by both parties, we determine that Petitioner has not demonstrated, by a preponderance of the evidence, that claims 1–12 of the ’565 patent are unpatentable.

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1–12 of the ’565 patent are unpatentable;

FURTHER ORDERED that Petitioner’s Motion to Exclude (Paper 33) is *dismissed in part* and *denied in part*; and

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

IPR2017-01312
Patent 6,461,565 B2

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