

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UMICORE AG & CO. KG,
Petitioner,

v.

BASF CORPORATION,
Patent Owner.

Case IPR2015-01121

Patent No. 7,601,662

PATENT OWNER BASF CORPORATION'S NOTICE OF APPEAL

UNDER 37 C.F.R. § 90.2(a)

Pursuant to 37 C.F.R. § 90.2(a), notice is hereby given that Patent Owner BASF Corporation (“BASF”) appeals to the United States Court of Appeals for the Federal Circuit from the Final Written Decision (Paper No. 53) (the “Final Written Decision”), in IPR2015-01121, entered on October 26, 2016, by the United States Patent and Trademark Office, Patent Trial and Appeal Board (“PTAB”), and from all underlying orders, decisions, rulings, and opinions. A copy of the Final Written Decision is attached hereto as Exhibit A.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), BASF further indicates that the issues on appeal may include, but are not limited to, the PTAB’s determination that claims 1-8, 12-24, 30, and 32-50 of U.S. Patent Number 7,601,662 have been shown to be unpatentable under 35 U.S.C. § 103 in view of the grounds of unpatentability identified in the Board’s Final Written Decision, challenges to any findings supporting the determination, the Board’s failure to properly consider evidence of record, the Board’s legal errors in undertaking the obviousness analysis, the Board’s finding that conflict with the evidence of record and are not supported by substantial evidence, and other issues decided adversely to Patent Owner.

Simultaneous with this submission, a copy of this Notice of Appeal is being filed with the PTAB through the Patent Trial and Appeal Board End to End (“PTAB E2E”) System. In addition, a copy of the Notice of Appeal, along with the

required docketing fee, are being filed with the Clerk's office for the United States Court of Appeals for the Federal Circuit.

Dated: December 27, 2016

Respectfully submitted,

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CERTIFICATE OF FILING

It is certified that, in addition to being filed electronically through the PTAB E2E System, the original version of Patent Owner BASF Corporation's Notice of Appeal has been sent via priority mail on December 27, 2016 with the Director of the United States Patent and Trademark Office, at the following address:

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United States Patent and Trademark Office
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CERTIFICATE OF FILING

It is certified that a true and correct copy of Patent Owner BASF Corporation's Notice of Appeal has been filed via CM/ECF on December 27, 2016, with the Clerk's Office of the United States Court of Appeals for the Federal Circuit.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on December 27, 2016, the foregoing **PATENT OWNER BASF CORPORATION'S NOTICE OF APPEAL** was served via electronic mail, upon the following:

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EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UMICORE AG & CO. KG,
Petitioner,

v.

BASF CORPORATION,
Patent Owner.

Case IPR2015-01121
Patent 7,601,662

Before CHRISTOPHER L. CRUMBLEY, JO-ANNE M. KOKOSKI, and
JEFFREY W. ABRAHAM, *Administrative Patent Judges*.

ABRAHAM, *Administrative Patent Judge*.

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

I. INTRODUCTION

Umicore AG & Co. KG (“Petitioner”) filed a Petition seeking *inter partes* review of claims 1–24, 30, and 32–50 of U.S. Patent No. 7,601,662 B2 (Ex. 1001, “the ’662 patent”), as amended by *Ex parte* Reexamination Certificate No. US 7,601,662 C1 (“Reexam. Cert.”). Paper 1 (“Pet.”). BASF Corporation (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 7. On October 29, 2015, we instituted an *inter partes* review of claims 1–8, 12–24, 30, and 32–50 as discussed below. Paper 8 (“Dec. on Inst.”).

After institution, Patent Owner filed a Patent Owner Response (Paper 24, “PO Resp.”), and Petitioner filed a Reply (Paper 36, “Reply”). An oral hearing was held on July 28, 2016, and a transcript of the hearing has been entered into the record of the proceeding as Paper 52 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. 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 shown by a preponderance of the evidence that claims 1–8, 12–24, 30, and 32–50 are unpatentable.

II. BACKGROUND

A. *Related Proceedings*

Petitioner identifies pending *inter partes* review Case IPR2015-01125, also pertaining to the ’662 patent. Pet. 1. In addition to IPR2015-01125, Patent Owner identifies pending *inter partes* review Cases IPR2015-01123 and -01124, pertaining to U.S. Patent No. 8,404,203 B2, which issued from a divisional of the application that issued as the ’662 patent. Paper 5, 2.

B. The '662 Patent

The '662 patent, titled “Copper CHA Zeolite Catalysts,” originally issued on October 13, 2009, with an *ex parte* reexamination certificate issuing on June 7, 2013. The '662 patent states that “synthetic and natural Zeolites and their use in promoting certain reactions, including the selective reduction of nitrogen oxides with ammonia in the presence of oxygen, are well known in the art,” and that “[m]etal-promoted Zeolite catalysts including, among others, iron-promoted and copper-promoted Zeolite catalysts, for the selective catalytic reduction of nitrogen oxides with ammonia are known.” Ex. 1001, 1:26–33.

The '662 patent discloses catalysts that comprise zeolites having a CHA crystal structure and include copper, which may be part of an exhaust gas treatment system. *Id.* at 1:55–61. According to the '662 patent, “novel copper chabazite catalysts are provided which exhibit improved NH₃ SCR of NO_x.” *Id.* at 1:64–66. Several embodiments described in the '662 patent depict a catalyst comprising a zeolite having the CHA crystal structure, a specific mole ratio of silica to alumina (e.g., greater than about 15), and a specific atomic ratio of copper to aluminum (e.g., greater than about 0.25). *Id.* at 4:24–29.¹ The '662 patent teaches that the catalyst compositions can be disposed on a substrate, which usually comprises a honeycomb structure. *Id.* at 6:55–59. According to the Specification, the CuCHA zeolite catalysts of the '662 patent are said to have increased hydrothermal stability (i.e.,

¹ For purposes of this decision, we follow the parties' convention of using “SAR” to refer to the mole ratio of silica to alumina, and “Cu/Al ratio” to refer to the atomic ratio of copper to aluminum required in the claims.

greater stability when subjected to thermal aging) as compared to other Cu-zeolite catalysts. *Id.* at 5:1–16, 5:49–52.

C. Illustrative Claim

Claim 1 is the only independent claim challenged, and is reproduced below:

1. A catalyst comprising:
an aluminosilicate zeolite having the CHA crystal structure and a mole ratio of silica to alumina from about 15 to about 150 and an atomic ratio of copper to aluminum from about 0.25 to about 1, the catalyst effective to promote the reaction of ammonia with nitrogen oxides to form nitrogen and H₂O selectively.

Ex. 1001, Reexam. Cert. 1:56–2:3 (annotations and emphasis omitted).

D. References

Petitioner relies on the following references:

Zones et al., US 6,709,644 B2, issued March 23, 2004 (“Zones,” Ex. 1004).

Maeshima et al., US 4,046,888, issued September 6, 1977 (“Maeshima,” Ex. 1002).

Patchett et al., US 2006/0039843 A1, published February 23, 2006 (“Patchett,” Ex. 1005).

E. Reviewed Grounds of Patentability

The Board instituted trial to review the patentability of the challenged claims on the following grounds:

References	Statutory Basis	Claims Challenged
Zones and Maeshima	§ 103	1–8 and 30
Zones, Maeshima, and Patchett	§ 103	12–24 and 32–50

F. Level of Ordinary Skill in the Art

Petitioner's declarant, Dr. Lercher, testified that a person of ordinary skill in the art "would have at least a Master's degree in chemistry or a related discipline, and have knowledge of the structure and chemistry of molecular sieves like zeolites, including factors that impact their stability and activity." Ex. 1008 ("Lercher Declaration") ¶ 66. Patent Owner's declarant, Dr. Tsapatsis, stated that he agrees with the level of ordinary skill in the art advanced by Dr. Lercher. Ex. 2018 ("Tsapatsis Declaration") ¶ 22.

We credit the testimony provided by the declarants for both parties and hold that one of skill in the art would possess at least a Master's degree in chemistry or a related discipline, and have knowledge of the structure and chemistry of molecular sieves like zeolites, including factors that impact their stability and activity. This level of ordinary skill is reflected not only by the information presented by the parties, but also by the prior art of record. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art itself can reflect the appropriate level of ordinary skill in the art).

III. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). We determine that no express claim construction is required for purposes of this Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795,

803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

B. References

1. Zones

Zones discloses aluminosilicate zeolites having the CHA crystal structure. Ex. 1004, 1:7–23 and Abstract (referring specifically to the chabazite structure). Zones teaches that its zeolite may have an SAR greater than 10. *Id.* at 1:7–10. Zones further discloses that its zeolite may be prepared from a mixture of reactants having SAR values ranging from 20 to 50, and preferably SAR values ranging from 25 to 40. *Id.* at 2:34 (Table 1); *see also id.* at 7:34–35, claim 3 (reciting an SAR of at least 30). Zones also discloses

an improved process for the reduction of oxides of nitrogen contained in a gas stream in the presence of oxygen wherein said process comprises contacting the gas stream with a zeolite, the improvement comprising using as the zeolite a zeolite having the CHA crystal structure, a mole ratio greater than about 10 of silicon oxide to aluminum oxide and having a crystallite size of 0.5 micron or less. The zeolite may contain a metal or metal ions (such as cobalt, copper or mixtures thereof) capable of catalyzing the reduction of the oxides of nitrogen In a preferred embodiment, the gas stream is the exhaust stream of an internal combustion engine.

Id. at 1:54–67.

Zones states that metals may be introduced into the zeolite “via standard ion exchange techniques” (*id.* at 4:25–27) or the zeolite can be “impregnated with metals” (*id.* at 4:36–40). Zones teaches that the zeolite may contain a metal cation “preferably in the range of from about 0.05 to 5 % by weight.” *Id.* at 5:25–28.

2. *Maeshima*

Maeshima “relates to a method for selectively reducing nitrogen oxides contained in exhaust gases from stationary sources, such as flue gas from the combustion furnace of power plants, by using ammonia as a reducing agent.” Ex. 1002, 2:9–13. According to Maeshima, this is accomplished by contacting a gaseous exhaust mixture with a catalyst in the presence of ammonia. *Id.* at 2:6–8. Maeshima teaches that the catalyst can be a crystalline aluminosilicate or a “product obtained by exchanging an alkali metal ion in a crystalline alumino-silicate with at least one metal cation having an activity of reducing nitrogen oxides.” *Id.* at 3:33–38. Maeshima lists “Chabazite,” among others, as a suitable natural zeolite to be used in the described method. *Id.* at 4:6–12. Maeshima includes copper in its list of the most preferred metal components that can be incorporated into the zeolite catalysts (*id.* at 6:4, 4:51–52), noting that “[t]he ion exchange ratio is not particularly critical, but it is generally preferred that the ion exchange ratio be about 60 to about 100%” (*id.* at 4:44–52) and also disclosing that the amount of the active metal component in the catalyst may be a “catalytically effective amount,” ranging from about 1 to about 20% by weight, preferably about 2 to about 10% by weight (*id.* at 6:13–17).

3. *Patchett*

Patchett relates to an emissions treatment system and method for reducing nitrogen oxides emissions in the exhaust stream produced from an internal combustion engine. Ex. 1005 ¶ 1. Patchett teaches that “[a] proven NO_x abatement technology applied to stationary sources with lean exhaust conditions is Selective Catalytic Reduction (SCR) using ammonia (NH₃) or an NH₃ precursor.” *Id.* ¶ 3.

Patchett discloses one embodiment of an emissions treatment system that includes an injector for inserting ammonia into an exhaust stream upstream from a first substrate with an SCR catalyst composition and an NH₃ destruction catalyst composition (comprising a platinum group metal component) disposed thereon. *Id.* ¶¶ 18–19. Patchett teaches that the SCR catalyst composition can contain a copper-exchanged zeolite and the substrate may be a honeycomb flow-through substrate. *Id.* ¶¶ 21, 23. According to Patchett, a copper-exchanged zeolite “typically [has] an effective SCR catalyst operating temperature range of from about 150 to 550 °C.” *Id.* at ¶ 69.

C. Analysis of Grounds of Unpatentability

1. Claims 1–8 and 30

As noted above, independent claim 1 recites a catalyst having the CHA crystal structure and specific SAR and Cu/Al values, which is effective to promote the reaction of ammonia with nitrogen oxides. Dependent claims 2–8 recite narrowed SAR and Cu/Al values, and dependent claim 30 recites an exhaust gas treatment system that comprises the catalyst of claim 2. Petitioner argues that that the subject matter of claims 1–8 and 30 would have been obvious over Zones² in view of Maeshima.

Petitioner provides detailed explanations and the declaration of Dr. Lercher to show how the references disclose or suggest each claim limitation. Pet. 10–23. In our Decision on Institution, we determined that Petitioner had made a threshold showing that the prior art discloses or

² Petitioner acknowledges that Zones was cited and considered by the Examiner during reexamination of the '662 patent, but points out that the combination of Zones and Maeshima was not before the Examiner in the reexamination. Pet. 4.

suggests all limitations of claims 1–8 and 30 sufficient for us to conclude that there was a reasonable likelihood that Petitioner would prevail in showing that the subject matter of the challenged claims would have been obvious in view of Zones and Maeshima. Dec. on Inst. 7–16.

In its Response, Patent Owner does not challenge Petitioner’s arguments and evidence demonstrating that the prior art discloses or suggests all limitations of the challenged claims. To the contrary, Patent Owner acknowledges that the limitations in the claims were well-known in the art. *E.g.*, PO Resp. 20 (“There was certainly nothing new in 2004 about a zeolite having the CHA structure and a SAR up to 50.”), 24 (“[I]t was known decades earlier, in 1985, that a high SAR CHA zeolite can be metal exchanged.”), 38 (stating that “it is undisputed that a high SAR CHA zeolite and the ion-exchange of copper in zeolite catalysts were well known in the art since at least 1985”); Tr. 8:11–14, 38:9–14. Thus, the record contains the same arguments and evidence regarding whether the prior art discloses or suggests the limitations of the challenged claims as it did at the time of our Decision on Institution.

Based upon our review of the totality of the record after trial, we agree with Petitioner’s arguments and evidence presented in the Petition regarding whether Zones and Maeshima disclose or suggest the limitations of claims 1–8 and 30. *See* Pet. 10–23. Thus, we determine that the preponderance of the evidence supports a finding that Petitioner has demonstrated that all limitations of claims 1–8 and 30 are disclosed or suggested by Zones and Maeshima.

In view of this, in our analysis below we focus on the remaining issues disputed by the parties, namely (i) whether Petitioner has shown one

of ordinary skill in the art would have been motivated to combine the teachings of Zones and Maeshima to arrive at the claimed CuCHA catalyst (PO Resp. 2, 25–30; Pet. 15–17) and (ii) whether Petitioner has shown that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones and Maeshima (PO Resp. 3, 30–32; Pet. 16–17).

i. Motivation to Combine Zones and Maeshima

a. Petitioner's Arguments

Petitioner argues that “[o]ne of ordinary skill in the art as of February 2007 would have been motivated to combine Zones with Maeshima to arrive, with a reasonable expectation of success, at the subject matter of the claims.” Pet. 15 (internal footnote omitted). Petitioner contends that Zones discloses zeolites with the CHA crystal structure and a high SAR value for the reduction of oxides of nitrogen. *Id.* at 10, 15–16; Tr. 15:5–7. Dr. Lercher notes that Zones “does recognize that ‘the zeolite may contain a metal or metal ions (such as . . . copper . . .)’.” Ex. 1008 ¶ 152 (quoting Ex. 1004, 1:61–63). Petitioner thus argues that Zones teaches the addition of copper, but does not explicitly disclose adding copper up to its ion exchange maximum. Tr. 16:1–5; Pet. 15–16.

Petitioner contends that a person of ordinary skill in the art would have known to add a metal up to its ion exchange maximum, and directs us to Maeshima, which, according to Petitioner, “says it directly.” Tr. 16:6–9, 117:21–22, 118:10–14, 119:14–16; Ex. 1008 ¶ 153; Pet. 16. Petitioner further contends that Maeshima discloses the incorporation of copper into aluminosilicate zeolites with the CHA crystal structure, and describes “the benefit of copper loading” (Pet. 16), which, according to Dr. Lercher,

includes “enhanc[ing] the effectiveness of a zeolite when catalyzing the reduction of nitrogen oxides” (Ex. 1008 ¶ 153). *See also* Tr. 116:12–24 (arguing that “effective” in this context means “effective to convert NO_x, which is the limitation of the claim”). Petitioner also argues that a person of ordinary skill in the art would have known that higher SAR zeolites were less susceptible to sulfate poisoning. Reply 17 (citing Ex. 1003, 47:47–53).

According to Petitioner, “[b]y directing one of ordinary skill to include copper in its zeolites to render them able to reduce NO_x in diesel exhaust, Zones sufficiently motivates those of skill to look to prior art references like Maeshima that discuss appropriate levels of copper loading to apply to an SCR catalyst.” *Id.* at 22; Tr. 97:18–19 (“Zones itself tells you what the motivation to combine with Maeshima is. It is to add copper.”); 100:10–15. Additionally, Petitioner argues that Zones and Maeshima are in the same technical field and directed to solving the same technical problem—catalyzing the reduction of nitrogen oxides—which would further motivate a person of ordinary skill in the art to combine the references. Pet. 17.

Petitioner further argues that “the motivation to modify a prior art reference to arrive at the claimed invention need not be the same motivation that the patentee had.” Reply 21 (quoting *Alcon Research, Ltd. v. Apotex, Inc.*, 687 F.3d 1362, 1368 (Fed. Cir. 2012)). Thus, according to Petitioner, whether Zones and Maeshima disclose a particular degree of SCR performance or hydrothermal stability is irrelevant, especially because these are not requirements of the claims. *Id.*

b. Patent Owner's Arguments

Patent Owner asserts that Petitioner's argument on motivation to combine is flawed because "neither reference teaches using a high SAR chabazite for ammonia SCR." Tr. 61:13–16. According to Patent Owner, "the use of the CHA structure for the NH₃ SCR of NO_x is a key aspect of the 662 invention, yet Petitioner and its expert simply presume that a person of ordinary skill in the art would have selected and modified a CHA zeolite for the NH₃ SCR of NO_x." PO Resp. 14–15. Patent Owner acknowledges that Zones teaches "the previously well-known proposition that metal-exchanged zeolites can be active for the reduction of oxides of nitrogen," but asserts that Zones does not disclose any specific reactions, such as the NH₃ SCR of NO_x. PO Resp. 2; Tr. 46:10–11. According to Patent Owner, Dr. Lercher incorrectly assumes that a person of ordinary skill in the art "would use [Zones'] CHA material for ammonia SCR, when, in fact, Zones does not teach that." Tr. 50:12–15.

Patent Owner acknowledges that Maeshima includes chabazite among its list of nine zeolites "suitable" for the NH₃ SCR of NO_x, but argues that Maeshima ultimately points one of ordinary skill in the art in the direction of a different zeolite, one having a low SAR and large pore size. PO Resp. 21, 28. Patent Owner argues that Zones, which is not about NH₃ SCR of NO_x specifically, teaches using a high SAR, lower pore size CHA zeolite. *Id.* at 26. Thus, according to Patent Owner, "there is simply no reason why one of ordinary skill in the art would have been motivated to combine the high SAR CHA zeolite disclosed in Zones with the ion-exchange ratio teaching in Maeshima for a low SAR, large pore size zeolite." *Id.* at 3.

Patent Owner further argues that a person of ordinary skill in the art would not be motivated to combine the teachings of Zones and Maeshima because “neither reference provides any suggestion that doing so would improve the zeolite for the SCR of NO_x.” *Id.* at 26. Patent Owner argues that none of the prior art references include any teachings regarding the *properties* of the CHA framework with regard to NH₃ SCR of NO_x. *Id.* at 18, 27–28. In this regard, Patent Owner argues that although Maeshima teaches using chabazite for ammonia SCR (Tr. 59:4–6), Maeshima does not say anything about how well chabazite works for the SCR of NO_x. Tr. 57:22–23; 58:8–9. Additionally, Patent Owner argues that neither Zones nor Maeshima suggests that the claimed features of CHA structure, SAR, and Cu/Al ratio will improve the activity or stability of the zeolite. PO Resp. 3, 26, 29.

Patent Owner cites to Byrne³ as the only prior art reference that discloses the properties of the CHA framework with regard to NH₃ SCR of NO_x. PO Resp. 18. According to Patent Owner, Byrne teaches not to use chabazite for this reaction because of susceptibility to sulfate poisoning, and instead discloses that zeolites having large pore sizes should be used. *Id.* at 27 (citing Ex. 1010 at 4:63–5:26); Tr. 50:20–23 (arguing that Byrne teaches to avoid using a copper chabazite for ammonia SCR). Patent Owner points out that other references teach that different zeolite frameworks, other than CHA, were being studied for NH₃ SCR of NO_x. PO Resp. 19. In this regard, Patent Owner argues that “Petitioner’s theory of obviousness is in direct conflict with the fact that it was known more than a decade before the 662 Patent was filed that the low hydrothermal stability of metal-exchanged

³ Byrne, U.S. Patent No. 4,961,917, issued Oct. 9, 1990 (Ex. 1010).

zeolites limited their usefulness for the NH₃ SCR of NO_x.” *Id.* at 5.

According to Patent Owner, the claimed CuCHA catalyst is a solution to this problem. *Id.*

c. Analysis

Evidence of a motivation to combine prior art references “may flow from the prior art references themselves [or] the knowledge of one of ordinary skill in the art.” *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1125 (Fed. Cir. 2000). It is undisputed that Zones discloses the synthesis of a high SAR CHA zeolite that may contain copper, which is “capable of catalyzing the reduction of the oxides of nitrogen.” Ex. 1004, 1:54–64. Zones explains that its zeolite can be used in an “improved process for the reduction of oxides of nitrogen contained in a gas stream,” wherein the gas stream is the exhaust stream of an internal combustion engine. *Id.* at 1:54–67.

Although Zones does not explicitly list specific reactions for the reduction of oxides of nitrogen, such as the use of CHA zeolites for ammonia SCR, the evidence of record suggests that a person of ordinary skill in the art would have understood the reference to the “reduction of oxides of nitrogen” to include ammonia SCR of NO_x. Ex. 2009, ¶ 8; Ex. 2027, 36:16–37:25; Tr. 46:21–23.

Maeshima discloses “various modifications and improvements” to methods for catalytic reduction of nitrogen oxides, including “a selective reduction method in which ammonia is used as the reducing [a]gent.” Ex. 1002, 1:19–26. In fact, Patent Owner states that “Maeshima itself . . . teach[es] metal-exchanged zeolites that are active for the NH₃ SCR of NO_x.” PO Resp. 30. Like Zones, Maeshima discloses removing nitrogen

oxides from a gas by contacting the gaseous mixture with a catalyst. Ex. 1002, 2:5–9. Maeshima states that “it is necessary to perform removal of nitrogen oxides while eliminating influences of sulfur oxides and oxygen.” *Id.* at 2:36–38. Maeshima includes chabazite among its list of zeolites that are “suitable” catalysts for the ammonia reduction of nitrogen oxides. *Id.* at 4:6–11. Maeshima also discloses “a product obtained by exchanging an alkali metal ion in a crystalline alumino-silicate with at least one metal cation having an activity of reducing nitrogen oxides” (*id.* at 3:35–38), wherein the active metal can be copper, and the ion exchange ratio is preferably about 60 to about 100% (*id.* at 4:44–52).

In view of this, we credit Dr. Lecher’s testimony that “it was well known in the prior art that copper should be beneficially incorporated into a catalyst in an amount approaching a 100% ion-exchange rate” and that “[i]t was also well known that up to a point, increased amounts of copper, including that achieved by a utilizing a 100% ion-exchange ratio or rate, enhance the effectiveness of a zeolite when catalyzing the reduction of nitrogen oxides.” Ex. 1008 ¶ 153. This statement is consistent with not only the prior art references, but also with testimony from Patent Owner’s declarant, Dr. Tsapatsis, who admitted that it was well-known that metals, such as copper, can be introduced into zeolites and make a zeolite active for the SCR of NO_x. Ex. 1019, 113:25–114:14; Ex. 2018 ¶ 94. Dr. Tsapatsis further admitted that a person of ordinary skill in the art would have known that a 60–100 % ion exchange ratio range was acceptable for incorporation of copper into any zeolite. Ex. 1019, 114:23–115:19.

Thus, we find that both the prior art references themselves, as well as the knowledge of a person of ordinary skill in the art, provide adequate reasons to combine Zones and Maeshima.⁴

In arguing that Maeshima directs a person of ordinary skill towards the “especially preferred” low SAR (2–6), large pore size (6–13 Angstroms) aluminosilicates, in contrast to the high SAR, small pore size CHA zeolite of Zones (PO Resp. 28), Patent Owner ignores the full disclosure of Maeshima, which describes preferred aluminosilicates as having “pore diameters in the range of about 3–15 Å and SiO₂/Al₂O₃ molar ratios of above about 2” and explicitly includes chabazites as suitable catalysts for SCR of NO_x (Ex. 1002, 3:68–4:11). *See Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1166 (Fed. Cir. 2006) (explaining that in an obviousness analysis, “the prior art must be considered as a whole for what it teaches”); *see also Merck & Co. v. Biocraft Labs. Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) (“[I]n a section 103 inquiry, ‘the fact that a specific [embodiment] is taught to be preferred is not controlling, since all disclosures of the prior art, including unpreferred embodiments, must be considered.’” (quoting *In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976))). Thus, contrary to Patent Owner’s contentions, the combined teachings of Zones and Maeshima disclose using a high SAR CHA zeolite for ammonia SCR.

⁴ We are not persuaded by Patent Owner’s argument that Petitioner does not explain “what a person of ordinary skill in the art would be attempting to achieve in combining Zones and Maeshima.” PO Resp. 30. Patent Owner cites to no legal authority establishing that this particular question, separate and apart from the question of whether Petitioner has established a reason to combine the prior art references, is part of an obviousness inquiry under 35 U.S.C. § 103.

Patent Owner's arguments that the prior art references fail to provide any suggestion that combining the high SAR and CHA framework of Zones with the ion exchange ratio of Maeshima "would improve the zeolite for the SCR of NO_x" is unconvincing. PO Resp. 26. Although finding an improved zeolite for the SCR of NO_x may have been the inventors' motivation, "[t]he skilled artisan need not be motivated to combine [the prior art] for the same reason contemplated by [the inventors]." *In re Kahn*, 441 F.3d 977, 990 (Fed. Cir. 2006); *see also KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 420, (2007) (stating that it is error to look "only to the problem the patentee was trying to solve").

As to Patent Owner's arguments regarding sulfur poisoning discussed in Byrne, we note that another prior art reference, Breck,⁵ discloses silicon substituted zeolites (including chabazites), which, "because they are more highly siliceous than their precursors[,] they are not only more thermally and hydrothermally stable than those prior known materials but also have increased resistance toward acidic agents such as mineral and organic acids, SO₂, SO₃, NO_x and the like." Ex. 1003, 4:60–63, 47:44–53.⁶ We also note that Byrne states "[a]s indicated by the prior art noted above, the utilization of high ratios of silica to alumina is known to enhance acid resistance of the zeolite and to provide enhanced resistance of the zeolite to acid sulfur poisoning." Ex. 1010, 5:39–44, *see also id.* at 1:28–33 (stating that "[t]he

⁵ Breck, U.S. Patent No. 4,503,023, issued March 5, 1985 (Ex. 1003).

⁶ Patent Owner argues that "[y]ou cannot translate what was taught in Breck to catalytic activity, because that's not what is said in Breck." Tr. 69:24–25. Breck, however, states that "[t]he novel zeolite compositions of the present invention are useful in all adsorption, ion-exchange and *catalytic processes* in which their less siliceous precursors have heretofore been suitably employed." Ex. 1003, 47:44–47 (emphasis added).

resistance of the catalyst to sulfurous poisons, particularly sulfur trioxide and sulfuric acid mist, is said to be enhanced by dealuminizing the mordenite to increase the silica to alumina ratio to more than 12, preferably to more than 15”). Furthermore, the Federal Circuit has held that “[a] known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.” *In re Gurley*, 27 F.3d 551, 554 (Fed. Cir. 1994). The same reasoning applies to Patent Owner’s arguments regarding additional publications allegedly describing the limited usefulness of metal-exchanged zeolites for the NH₃ SCR of NO_x.

Thus, upon consideration of the evidence in this record, we determine that Petitioner has demonstrated, by a preponderance of the evidence, that a person of ordinary skill in the art would have had a reason to combine Zones and Maeshima to arrive at the claimed subject matter.

ii. Reasonable Expectation of Success in combining Zones and Maeshima

Petitioner argues that a person of ordinary skill in the art would have had “every reason to believe that increasing the copper of Zone[s]’ zeolites catalysts as instructed by Maeshima would succeed.” Pet. 16–17. Petitioner argues that the ’662 patent itself acknowledges that “[m]etal promoted zeolite catalysts, including, among others, iron-promoted and copper promoted zeolite catalysts, for the selective catalytic reduction of nitrogen oxides with ammonia are known.” Ex. 1001, 1:30–33; Pet. 16. Petitioner also relies on Maeshima’s disclosure of incorporating metal cations into zeolites via ion-exchange, including specific amounts of active metals such as copper. Pet. 16. According to Petitioner,

the combination of Zones and Maeshima amounts to nothing more than the application of one particular known modification to catalytic zeolites with a known benefit—increasing the copper content of aluminosilicate chabazite zeolites to improve catalytic activity as taught by Maeshima—to the very materials to which this modification is meant to be applied—Zones high SAR copper-promoted aluminosilicate zeolites for use in SCR processes.

Id. at 17.

Patent Owner argues Petitioner has failed to establish a reasonable expectation of success in combining Zones and Maeshima. PO Resp. 31–32. In particular, Patent Owner argues that neither reference offers teachings regarding solving the problem of hydrothermal stability, and, therefore, a person of ordinary skill in the art would not have a reasonable expectation that the combination of Zones and Maeshima would provide “a zeolite catalyst that is active for NH₃ SCR of NO_x and exhibits improved hydrothermal stability as compared to other known zeolite catalysts.” *Id.* at 31.

Our reviewing court has held that “the person of ordinary skill need only have a reasonable expectation of success of developing the *claimed invention.*” *Allergan, Inc. v. Sandoz Inc.*, 726 F.3d 1286, 1292 (Fed. Cir. 2013)) (emphasis added). Patent Owner’s arguments are directed to making a zeolite catalyst that exhibits improved hydrothermal stability. Claims 1–8 and 30, however, do not include a limitation regarding hydrothermal stability. We, therefore, agree with Petitioner that “[o]ne of ordinary skill in the art’s expectations regarding the hydrothermal stability of Zones’ and Maeshima’s catalysts is irrelevant.” Reply 23.

Claims 1–8 and 30 require that the catalyst is “effective to promote the reaction of ammonia with nitrogen oxides to form nitrogen and H₂O

selectively.” According to Patent Owner, “[i]t is undisputed that it was known that zeolites *can* be metal ion-exchanged at a ratio between 60-100%, and that metal-exchanged zeolites are catalytically active.” PO Resp. 32. In view of this, Maeshima’s teaching that a CHA zeolite is a suitable catalyst for the NH₃ SCR of NO_x, coupled with its teaching that the catalyst can include an active metal such as copper, ion-exchanged at a ratio of about 60 to about 100%, provides a reasonable expectation of successfully combining Maeshima with Zones’ high SAR chabazite catalyst (itself described as being capable of catalyzing the reduction of oxides of nitrogen) to arrive at a zeolite that is catalytically active for the NH₃ SCR of NO_x.

Accordingly, we find that Petitioner has established by a preponderance of evidence that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones and Maeshima to arrive at the claimed invention.

2. *Claims 12–24 and 32–50*

Claims 12–24 and 32–38 depend from claim 2, and recite additional limitations such as the catalyst being deposited on a honeycomb substrate (claim 12), the honeycomb substrate comprising a wall flow filter substrate (claim 13) or a flow through substrate (claim 14), coating a portion of the flow through or wall flow substrate with Pt and CuCHA adapted to oxidize ammonia in the exhaust gas stream (claims 16 and 17), placing the catalyst downstream from a diesel engine and an injector that adds a reductant to an exhaust gas stream (claims 21–24), and including a catalyzed soot filter (claim 32). Ex. 1001, 23:48–24:23, 24:49–65; Reexam. Cert. 2:12–13. Claims 39–50 depend from claim 3 and contain limitations similar to those in claims 12–24. Reexam. Cert. 2:14–59.

Petitioner provides detailed explanations and the declaration of Dr. Lercher to show how the references disclose or suggest each limitation of claims 12–24 and 32–50. Pet. 23–45. In its Response, Patent Owner does not challenge Petitioner’s arguments and evidence demonstrating that the prior art discloses or suggests all limitations of these claims. Thus, the record contains the same, and now undisputed and uncontested, arguments and evidence regarding whether the prior art discloses or suggests the limitations of the challenged claims as it did at the time of our Decision on Institution.

Based upon our review of the totality of the record after trial, we agree with Petitioner’s arguments and evidence presented in the Petition regarding whether Zones, Maeshima, and Patchett disclose or suggest the limitations of claims 12–24 and 32–50. *See* Pet. 23–45. Thus, we determine that the preponderance of the evidence supports a finding that Petitioner has demonstrated that all limitations of the challenged claims are disclosed or suggested by Zones, Maeshima, and Patchett.

In view of this, in our analysis below, we focus on the remaining issues disputed by the parties, namely (i) whether Petitioner has shown why one of ordinary skill in the art would have been motivated to combine the teachings of Zones, Maeshima, and Patchett to arrive at the claimed invention (PO Resp. 4–5, 33–35; Pet. 30–31) and (ii) whether Petitioner has shown that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones, Maeshima, and Patchett (PO Resp. 4–5, 35–37; Pet. 31–32).

i. Motivation to Combine Zones, Maeshima, and Patchett

Petitioner argues that a person of ordinary skill in the art “would have been motivated to use the high silica, copper promoted zeolites with the CHA crystal structure set forth in Zones and Maeshima as part of Patchett’s SCR system to arrive, with a reasonable expectation of success, at the claimed subject matter.” Pet. 30. Petitioner notes that Patchett teaches the use of a copper-exchanged zeolite to reduce nitrogen oxides in diesel engine exhaust. *Id.* Petitioner states that Patchett does not specifically reference a CHA zeolite or the claimed SAR and Cu/Al ratios, but does “identify the characteristics of the zeolite that should be employed.” *Id.* According to Petitioner, these characteristics include the ability of a catalyst to be used in connection with an internal combustion engine, copper present in an amount of 1–5 % by weight, and a SAR greater than 10. *Id.* at 30–31. Dr. Lercher states that Patchett also teaches the use of zeolites that are resistant to sulfur poisoning and sustain a high level of activity when exposed to high temperatures and hydrothermal conditions. Ex. 1008, ¶ 246 (citing Ex. 1005, ¶ 66).

Petitioner asserts that Zones and Maeshima disclose catalytic material having Patchett’s desired characteristics, namely an SAR greater than 10 and approximately 2–10% copper by weight, which can be used in an internal combustion engine. Ex. 1008 ¶ 251. Dr. Lercher states that “due to their increased levels of silica, the zeolites of Zones and Maeshima will provide improved stability when the catalytic materials are exposed to elevated thermal and hydrothermal conditions.” *Id.* Therefore, Petitioner contends that “one of ordinary skill in the art would be directed to the catalytic

material of Zones and Maeshima when attempting to implement Patchett's process." Pet. 31.

Petitioner also argues that a person of ordinary skill in the art would have been motivated to combine Zones, Maeshima, and Patchett because these references are "in the same technical field (catalysts and catalytic processes) and are directed to solving the same problem (catalyzing the reduction of nitrogen oxides in gas streams)." *Id.* (citing Ex. 1008 ¶ 252). Petitioner contends that the specific limitations included in claims 12–24 and 32–50, such as coated flow through and wall flow substrates, are "only obvious design choices . . . routinely included as part of a system to treat engine exhaust." *Id.* at 32 (citing Ex. 1008 ¶ 255).

Patent Owner argues that Petitioner ignores the fact that paragraph 66 of Patchett explains that suitable zeolites have a pore size of at least 7 Angstroms. PO Resp. 34 (citing Ex. 1005 ¶ 66). Patent Owner further argues that Byrne and Speronello,⁷ incorporated by reference in Patchett and characterized as describing "[s]uitable SCR catalyst compositions" that may be used in Patchett's system, promote the use of zeolites having large pore sizes. *Id.* (citing Ex. 1010, Abstract; Ex. 1011, 6:28–59). Additionally, Patent Owner reiterates its argument that Byrne teaches away from the use of copper-exchanged naturally occurring chabazite for the NH₃ SCR of NO_x. *Id.* at 33. Patent Owner asserts that Petitioner has not provided an explanation (other than hindsight) for why a person of ordinary skill in the art would disregard the teachings of Patchett, Byrne, and Speronello, and use Zones' CHA zeolite having a small pore size. *Id.* at 34–35.

⁷ Speronello, U.S. Patent No. 5,516,497, issued May 14, 1996 (Ex. 1011).

As Petitioner points out, however, Zones discloses the use of a high SAR, copper-loaded CHA zeolite in a process for “the reduction of the oxides of nitrogen contained in a gas stream,” wherein, in a preferred embodiment, “the gas stream is the exhaust stream of an internal combustion engine.” Ex. 1004, 1:54–67; Pet. 32. As discussed above, evidence in the record supports Petitioner’s contention that an increased level of silica (i.e., high SAR) in the chabazite zeolites of Zones and Maeshima results in improved resistance to sulfur poisoning and increased hydrothermal stability. Ex. 1008, ¶ 251; Ex. 1003, 4:60–63, 47:44–53; Ex. 1010, 1:28–33, 5:39–44. For example, Breck discloses silicon substituted CHA zeolites which, “because they are more highly siliceous than their precursors[,] they are not only more thermally and hydrothermally stable than those prior known materials but also have increased resistance toward acidic agents such as mineral and organic acids, SO₂, SO₃, NO_x and the like.” Ex. 1003, 4:60–63, 47:44–53.

We credit Dr. Lercher’s testimony that zeolites suitable for use in Patchett’s system (1) incorporate an active metal such as copper, (2) have an SAR above 10, (3) are resistant to sulfur poisoning, and (4) retain catalytic activity when subject to high temperatures and hydrothermal conditions. Ex. 1008 ¶ 246–249. We also credit Dr. Lercher’s explanation that a person of ordinary skill in the art would consider the zeolites of Zones and Maeshima for use in Patchett’s system because they can be used to treat the exhaust of an internal combustion engine and possess the aforementioned properties of a catalyst suitable for use in Patchett’s system. Ex. 1008 ¶¶ 250–251.

As to Patent Owner’s arguments regarding pore size, Patchett explains that

[i]t has been found that zeolites which are highly resistant to sulfate poisoning and provide good activity for both the SCR process and the oxidation of ammonia with oxygen, and which retain good activity even when subject to high temperatures, hydrothermal conditions and sulfate poisons, are zeolites which have pores which exhibit a pore diameter of at least about 7 Angstroms and are interconnected in three dimensions.

Ex. 1005 ¶ 66. Although clearly recognizing a correlation between larger pore size and the desired properties of a zeolite catalyst, we do not consider this language in Patchett to require the use of zeolites having a pore size of at least 7 Angstroms. This is consistent with the fact that Speronello, incorporated by reference in Patchett, discloses the use of “medium to large pore zeolites having pore openings of at least about 4 Angstroms in diameter.” Ex. 1011, 6:28–30; PO Resp. 23; Ex. 1005, ¶ 65.

We next address Patent Owner’s argument that “Byrne teaches away from using copper-exchanged naturally occurring chabazite for the NH₃ SCR of NO_x.” PO Resp. 33. Byrne discloses that “naturally occurring chabazite” showed a reduction in SCR process activity upon exposure to a gas stream containing varying amounts of SO₂, and, therefore, promotes the use of a large pore size zeolite framework. Ex. 1010, 4:57–5:26; Ex 2018 ¶ 133. Byrne, however, also teaches that “the utilization of high ratios of silica to alumina is known to enhance acid resistance of the zeolite and to provide enhanced resistance of the zeolite to acid sulfur poisoning.” Ex. 1010, 5:39–43. We are thus not persuaded that a person of ordinary skill in the art, upon reading Byrne, “would be led in a direction divergent from the path that was taken by the applicant,” namely the use of *high SAR* CHA zeolites to treat engine exhaust. *Ricoh Co., Ltd. v. Quanta Computer Inc.*, 550 F.3d 1325, 1332 (Fed. Cir. 2008). To the contrary, we credit Dr.

Lercher's testimony, that one of ordinary skill in the art would consider Zones' zeolites to be suitable for use in Patchett's system due to their high SAR. Ex. 1008, ¶ 251; Reply 24.

Thus, despite Zones' catalysts having a smaller pore size than those promoted in Patchett, Byrne, and Speronello, we are persuaded by Petitioner's evidence and arguments demonstrating that a person of ordinary skill in the art would be motivated to combine Zones, Maeshima, and Patchett based on the desired properties of suitable catalysts for use in Patchett, and the corresponding properties being shown in the Zones and Maeshima zeolites. *KSR*, 550 U.S. at 421 ("A person of ordinary skill is also a person of ordinary creativity, not an automaton.").

For all of the foregoing reasons, based upon consideration of the evidence in this record, we determine that Petitioner has demonstrated, by a preponderance of the evidence, that a person of ordinary skill in the art would have had a reason to combine Zones, Maeshima, and Patchett to arrive at the claimed subject matter.

ii. Reasonable Expectation of Success in Combining Zones, Maeshima, and Patchett

Petitioner argues that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones, Maeshima, and Patchett because Zones states that its catalysts can be used in an internal combustion engine, which "would indicate to one of ordinary skill in the art that the zeolites of Zones and Maeshima have applicability in and could be successfully used with Patchett." Pet. 32; Ex. 1008 ¶ 258.

In general, Patent Owner argues that Petitioner and Dr. Lercher provide only a cursory opinion regarding an expectation of success, and ignore the reasons stated in the prior art that a CHA material would be

unsuitable for use in Patchett's system. PO Resp. 35–36 (citing Exhibit 1005 ¶ 66; Exhibit 1010, Abstract, 4:57–5:25; Exhibit 1011, 6:28–59; Ex. 2018 ¶ 133). For the reasons discussed above, we find that the high SAR, copper-loaded zeolites disclosed in the combined teachings of Zones and Maeshima would be suitable for use in Patchett's system.

Patent Owner makes a separate argument with regard to claims 13, 18–20, 23, 24, 39, 44–46, 49, and 50, which require, *inter alia*, disposing the catalyst on a wall flow filter. For these claims, Patent Owner argues that Dr. Lercher and Petitioner rely on the disclosure of paragraph 63 of Patchett. PO Resp. 36; Ex. 2018 ¶ 134. According to Patent Owner, paragraph 63 of Patchett incorporates by reference a patent application (Ex. 1006) that sets forth specific requirements for a SCR catalyst disposed on a wall flow filter, namely that it “maintains its SCR catalytic activity even after prolonged exposure to higher temperatures that are characteristic of filter regeneration. For example, combustion of the soot fraction of the particulate matter often leads to temperatures above 700° C.” PO Resp. 36 (quoting Ex. 1006 ¶ 11); Ex. 2018 ¶ 134; Ex. 1005 ¶ 63.

Patent Owner argues Zones provides no teachings regarding hydrothermal stability for the NH₃ SCR of NO_x and Maeshima explicitly limits the reaction temperature for its SCR catalysts to between 200 °C and 500 °C. PO Resp. 36 (citing Ex. 2027, 47:22-48:17; Ex. 1002, 2:22–53; Ex. 2018 ¶ 135). Thus, “one of ordinary skill in the art would not have any expectation that the zeolites disclosed in Maeshima and Zones would have the hydrothermal stability required for the wall flow filter disclosed in Patchett.” Ex. 2018 ¶ 135; PO Resp. 36.

As discussed above, “the person of ordinary skill need only have a reasonable expectation of success of developing the *claimed invention*.” *Allergan*, 726 F.3d at 1292 (emphasis added). Claims 13, 18–20, 23, 24, 39, 44–46, 49, and 50 do not contain a limitation regarding hydrothermal stability, let alone a requirement for thermal stability up to a temperature of 700 °C. Instead, these claims require the catalyst described in claim 1 of the ’662 patent be disposed on a wall flow filter.

For the reasons described above, we find that Petitioner has established that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones and Maeshima to arrive at the zeolite that is catalytically active for the NH₃ SCR of NO_x required in claim 1. Furthermore, Zones teaches that its high SAR, copper-loaded CHA zeolite can be used to treat exhaust from an internal combustion engine, and Patchett describes coating a wall flow substrate with a high SAR, copper-loaded zeolite catalyst as part of an emissions treatment system for reducing NO_x emissions in the exhaust stream produced from an internal combustion engine. Ex. 1005 ¶¶ 1, 25; Ex. 1004, 1:54–67. These teachings in the prior art provide a reasonable expectation of success in achieving the subject matter of claims 13, 18–20, 23, 24, 39, 44–46, 49, and 50.

Additionally, as Petitioner points out, Breck indicates that high SAR chabazites demonstrate improved hydrothermal stability. Ex. 1003, 47:44–53. Moreover, in the section titled “SCR Catalyst Compositions,” Patchett states that its copper-exchanged zeolites that are used as coatings “typically have an effective SCR catalyst operating temperature range from 150 to 550 °C.” Ex. 1005 ¶ 69. We note that this temperature range corresponds to the operating temperature range expressly disclosed in Maeshima. This

evidence further suggests that a person of ordinary skill in the art would have had a reasonable expectation of success even though neither Zones nor Maeshima explicitly states that its zeolites are able to be used at temperatures above 700 °C. *See Reply 25.*

Accordingly, Petitioner has demonstrated by a preponderance of the evidence that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Zones, Maeshima, and Patchett to arrive at the claimed subject matter.

3. Objective Indicia of Non-obviousness

Patent Owner argues that objective indicia of skepticism, unexpected results, and commercial success direct a finding of non-obviousness. PO Resp. 37–54.

a. Commercial Success

Patent Owner states that it sells the claimed catalyst for use in the NH₃ SCR of NO_x in diesel engines.⁸ Patent Owner contends that the global market for SCR catalysts in diesel engines has doubled in the last five years and provides evidence of “the estimated market share that has been satisfied with the claimed CuCHA catalyst.” PO Resp. 45 (citing Ex. 2034 ¶¶ 6–7).

Patent Owner’s evidence of the percentage of the global market satisfied by the claimed catalyst is based on sales of “BASF CuCHA catalysts” and “estimates regarding the sales by BASF licensees.” Ex. 2034 ¶ 7. As Petitioner correctly notes, and Patent Owner admits, there is no evidence in the record demonstrating that the sales by BASF licensees

⁸ Patent Owner argues that the catalyst it sells is coextensive with the claims of the ’662 patent, and, therefore, the commercial success is presumed to be due to the patented invention. PO Resp. 45.

involve products that fall within the scope of the claims. Reply 19; Tr. 88:21–22. Moreover, Patent Owner has not provided evidence demonstrating what percentage of sales can be attributed to “BASF CuCHA catalysts” as opposed to “sales by BASF licensees.” Reply 19–20; Tr. 88:15–89:6. We, therefore, agree with Petitioner that “it is impossible to determine from the evidence [Patent Owner] has presented what percentage of the global SCR market is actually accounted for by claimed products.” Reply 19–20. As a result, the lack of specific proof regarding sales of claimed products and market share renders Patent Owner’s evidence insufficient for purposes of establishing commercial success. *See In re Applied Materials, Inc.*, 692 F.3d 1289, 1300 (Fed. Cir. 2012); *see also In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996) (“The more probative evidence of commercial success relates to whether the sales represent a substantial quantity in th[e] market.”).

b. Skepticism

Patent Owner cites to several documents as evidence of “[s]kepticism about the viability of copper exchanged zeolites.” PO Resp. 39–41 (citing Ex. 2012; Ex. 2001; Ex. 2026; Ex. 2021).

Petitioner argues that the documents Patent Owner cites address the commercial viability of copper exchanged zeolites based on hydrothermal stability. Reply 11–12. Petitioner notes that the challenged claims do not require a commercially viable catalyst or a catalyst that exhibits any particular degree of hydrothermal stability. *Id.* at 12.

We have reviewed Patent Owner’s evidence of skepticism and find it to be insufficient, as it fails to show the skepticism has a sufficient nexus to the claimed invention. *See Muniauction, Inc. v. Thompson Corp.*, 532 F.3d

1318, 1327–28 (Fed. Cir. 2008) (indicating that the requirement of a nexus between the claimed invention and evidence of secondary considerations applies equally to skepticism). To the contrary, the evidence of record shows that doubts about hydrothermal stability and the resulting commercial applicability of copper-zeolite catalysts prompted the skepticism.⁹ For example, the Centi paper published in 1995 states that “for practical applications their *low hydrothermal stability* may prevent a *commercial use*.” Ex. 2012, 184 (emphasis added). According to the declaration of Mr. Roth, a Department of Energy grant proposal was wait-listed because “Cu-exchanged zeolites lack *hydrothermal stability* needed to be *commercially viable* for SCR of NO_x with ammonia for diesel engines.” Ex. 2001 ¶ 4 (emphasis added).¹⁰ The other articles Patent Owner cites similarly refer to the lack of a “commercial breakthrough” and limited hydrothermal stability. PO. Resp. 40–41 (citing Ex. 2026, 182; Ex. 2021, 218). As Petitioner points out, the claims require only a CHA zeolite that is effective for the NH₃ SCR of NO_x.

⁹ We find this evidence sufficient to rebut any presumption of a nexus between the claimed invention and skepticism that may exist based upon Patent Owner’s argument that it is entitled to such a presumption with regard to commercial success. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1330 n. 4 (Fed. Cir. 2016).

¹⁰ This evidence contradicts Patent Owner’s argument that “[t]he skepticism was whether you could use a zeolite catalyst in a diesel engine.” Tr. 76:21–23. To the contrary, the evidence of record indicates that the skepticism was based on the *hydrothermal stability* and *commercial viability* of catalysts used with diesel engines. We recognize that certain claims (e.g., 47–50) recite using the claimed catalyst downstream from a diesel engine. These claims, however, do not require a specific level of catalyst activity, hydrothermal stability, or commercial viability.

c. Unexpected Results

Patent Owner contends that “[t]he unexpected properties of the claimed CuCHA catalyst for the SCR of NO_x are demonstrated by substantial evidence.” PO Resp. 41. As evidence of unexpected results, Patent Owner relies on the performance properties (e.g., low temperature activity, high temperature activity and degradation due to hydrothermal aging) of Examples 2, 3, and 4 presented in Table 1 of the ’662 patent. PO Resp. 41–42; Ex. 1001, 13:15–37, Table 1.

These Examples each involve a catalyst having a SAR of 30 and a Cu/Al ratio in the range of 0.33–0.44. Ex. 1001, 11:39–12:19, Table 1; Reply 14. Claim 1 of the ’662 patent, however, encompasses SAR values from about 15 to about 150, and Cu/Al ratios from about 0.25 to about 1. Patent Owner admits that “the examples in table 1 are not of the same scope as claim 1.” Tr. 86:23–24. Thus, it is undisputed that Patent Owner’s evidence of unexpected results is not commensurate in scope with independent claim 1. Instead, Patent Owner argues that the Examples in table 1 “line up with the dependent claims.” *Id.* at 86:24–25.

The claims of the subject patent must be shown to be commensurate in scope with the asserted showing of unexpected results advanced by Patent Owner. *See In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983); *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“the applicant’s showing of unexpected results must be commensurate in scope with the claimed range”); *In re Clemens*, 622 F.2d 1029, 1035 (CCPA 1980) (“In order to establish unexpected results for a claimed invention, objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.”). Patent Owner, however, does not specify

which dependent claims “line up” with Examples 2, 3, and 4 for purposes of establishing unexpected results, or provide any further information or argument.

Patent Owner also directs us to Byrne and a 2015 paper as additional evidence of unexpected results. PO Resp. 43–44. In response, Petitioner notes that, in view of at least Breck, a person of ordinary skill in the art “would not have found it unexpected that a CHA zeolite could be useful as a catalyst.” Reply 17. For the reasons discussed above, we agree with Petitioner. Petitioner also correctly criticizes Patent Owner’s reliance on an article from 2015 to show the claimed process yielded unexpected results. *See Bristol-Myers Squibb Co. v. Teva Pharm. USA, Inc.*, 769 F.3d 1339, 1340–41 (Fed. Cir. 2014) (per curiam) (Dyk, J., concurring) (“This case presents a question of obviousness, in particular whether evidence postdating the invention can be used to establish unexpected results. The panel holds that it cannot be considered in the circumstances of this case.”). Even if we did consider it, Patent Owner has not explained sufficiently why an article debating the mechanism behind *why* CHA zeolites work for NH₃ SCR constitutes evidence of unexpected results regarding *how well* the CHA zeolites perform, especially considering the mechanism is not recited in the claims.

Based on the foregoing, we determine that Patent Owner has not offered sufficient evidence to establish unexpected results.

IV. CONCLUSION

In view of the undisputed evidence that all elements of claims 1–8, 12–24, 30, and 32–50 are in the prior art, our determination that a person of ordinary skill in the art would have had reason to combine the references

with a reasonable expectation of success, and the lack of any persuasive evidence of objective indicia of nonobviousness, we determine that the subject matter of claims 1–8, 12–24, 30, and 32–50 would have been obvious to a person of ordinary skill in the art.

V. PETITIONER’S MOTION TO EXCLUDE EVIDENCE

Petitioner filed a Motion to Exclude (Paper 42) in which Petitioner seeks to exclude several paragraphs from the Declaration of Dr. Tsapatsis (Ex. 2018), paragraph 11 of the Declaration of Dr. Moini (Ex. 2019), and paragraph 7 of the Declaration of Olivia Schmidt (Ex. 2034). Paper 42, 1.

We do not reach the merits of Petitioner’s Motion to Exclude because, as explained above, even if the disputed evidence is considered, Petitioner has shown by a preponderance of evidence that claims 1–8, 12–24, 30, and 32–50 are unpatentable as obvious. Accordingly, Petitioner’s Motion to Exclude is dismissed as moot.

VI. MOTION TO SEAL

Patent Owner filed an unopposed Combined Motion to Seal and Motion for Protective Order. Paper 23. In its motion, Patent Owner seeks entry of a proposed Protective Order that “is consistent with the Default Protective Order of this Board with certain edits applicable to this case.” Paper 23, 5. Patent Owner moves to seal portions of Exhibits 2019 and 2034, and asserts that these exhibits contain non-public technical and business information that is confidential to Patent Owner. Paper 23, 2. Petitioner filed a Motion to Seal Exhibit 1020, which contains deposition testimony relating to the confidential information in Exhibit 2034. Paper 38, 1. Patent Owner filed redacted versions of Exhibits 2019 and 2034, and Petitioner filed a redacted version of Exhibit 1020.

Upon review, good cause exists to enter the proposed Protective Order and seal the above information as set forth in the above motions.

VII. ORDER

For the reasons given, it is hereby

ORDERED that claims 1–8, 12–24, 30, and 32–50 of U.S. Patent No. 7,601,662 are *unpatentable*;

FURTHER ORDERED that Petitioner’s Motion to Exclude Evidence (Paper 42) is *dismissed as moot*;

FURTHER ORDERED that Patent Owner’s Motion to Seal and Motion for Protective Order (Paper 23) is *granted*;

FURTHER ORDERED that Petitioner’s Motion to Seal (Paper 38) is *granted*; and

FURTHER ORDERED that, because this is a final 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.

IPR2015-01121
Patent 7,601,662

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