

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Guido William Aru
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Title: CO TO CO₂ COMBUSTION PROMOTER

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 11,224,864 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBITS

WRG-1001	U.S. Patent No. 11,224,864 to Aru (“the ’864 Patent”)
WRG-1002	Excerpts from the Prosecution History of the ’864 Patent (“the Prosecution History”)
WRG-1003	Declaration of Dr. Michael P. Harold, Ph.D.
WRG-1004	U.S. Patent Application 2007/0197379 to Miura (“Miura”)
WRG-1005	U.S. Patent No. 6,509,290 to Vaughn, et al. (“Vaughn-290”)
WRG-1006	U.S. Patent No. 6,358,881 to Peters, et al. (“Peters”)
WRG-1007	U.S. Patent Application 2005/0054516 to Vaughn, et al. (“Vaughn-516”)
WRG-1008	U.S. Patent No. 7,053,024 to Baker, et al. (“Baker”)
WRG-1009	Great Britain Patent No. 2,310,384 to Lin, et al. (“Lin”)
WRG-1010	Standard Test Method for Determination of Attrition of FCC Catalysts by Air Jet (D5757) (“ASTM Standard”)
WRG-1011	U.S. Patent No. 7,230,035 to Espinoza (“Espinoza”)
WRG-1012	I.V. Babich, K. Seshan, L. Lefferts, “Nature of nitrogen specie in coke and their role in NO _x formation during FCC catalyst regeneration,” <i>Appl. Catal. B. Environmental</i> , 59, 205-211 (2005) (“Babich”)
WRG-1013	Lang, W., P. Laing, Y. Cheng, C. Hubbard, and M.P. Harold, “Co-Oxidation of CO and Propylene on PD/CeO ₂ -ZrO ₂ and PD/Al ₂ O ₃ Monolith Catalysts: A Light-off, Kinetics, and Mechanistic Study,” <i>Appl. Catal. B. Environ.</i> , 218, 430-442 (2017) (“Lang”)
WRG-1014	D. Wu, F. Wu, Z. Gu, “Catalyst Attrition in an ASTM Fluidized Bed,” <i>Catalysis Today</i> , 264 (2016) 70-74 (“Wu”)
WRG-1015	R. Cocco, Y. Arrington, R. Hays, J. Findlay, “Jet Cup Attrition Testing,” <i>Powder Tech.</i> , 200 (2010) 224-233 (“Cocco”)
WRG-1016	G.W. Aru Proposed Claim Construction Statement

CLAIM LISTING

Limitation	Claim Language
[1pre]	A CO to CO ₂ combustion promoter comprising microsphere sized porous particles, each microsphere sized porous particle having a diameter of less than 1mm, and independently comprising
[1a]	silica, alumina, or mixtures thereof; and
[1b]	one or more Group VIII noble metals distributed in the particle as an eggshell such that a higher concentration of the one or more Group VIII noble metals is present in the outer region of the microsphere sized porous particle as compared to the concentration of the one or more Group VIII noble metals in the centre of the microsphere sized porous particle.
[2]	The combustion promoter according to claim 1, comprising a plurality of microsphere sized porous particles comprising silica.
[3]	The combustion promoter according to claim 1, comprising a plurality of microsphere sized porous particles comprising alumina.
[4]	The combustion promoter according to claim 1, comprising a first plurality of microsphere sized porous particles comprising silica and a second plurality of microsphere sized porous particles comprising alumina.
[5]	The combustion promoter according to claim 1, comprising a plurality of microsphere sized porous particles comprising silica and alumina.
[6]	The combustion promoter according to claim 1, wherein the microsphere sized porous particles collectively have an average (D50) size of between 60 and 90 microns as measured by laser diffraction.
[7]	The combustion promoter according to claim 1, wherein the microsphere sized porous particles are gamma or theta alumina particles.
[8]	The combustion promoter according to claim 1, wherein the microsphere sized porous particles are spray dried silica particles.

Limitation	Claim Language
[9]	The combustion promoter according to claim 1, wherein the microsphere sized porous particles are an equilibrium or spent catalyst as obtained from a fluidized catalytic cracking (FCC) process.
[10]	The combustion promoter according to claim 1, wherein the attrition index as measured according to ASTM D-5757 of the CO to CO ₂ combustion promoter for a sieve fraction of combustion promoter particles of between 40 and 105 microns is between 5 and 25.
[11]	The combustion promoter according to claim 10, wherein the attrition index of the CO to CO ₂ combustion promoter for a sieve fraction of combustion promoter particles of between 40 and 105 microns is between 10 and 20.
[12]	The combustion promoter according to claim 1, wherein the one or more Group VIII noble metals comprises one or more of platinum, palladium, iridium, ruthenium, and rhodium.
[13]	The combustion promoter according to claim 12, wherein the one or more Group VIII noble metals comprises platinum and palladium.
[14]	The combustion promoter according to claim 12, wherein the one or more Group VIII noble metals comprises platinum.
[15]	The combustion promoter according to claim 12, wherein the one or more Group VIII noble metals comprises palladium.
[16]	The combustion promoter according to claim 1, wherein the microsphere sized porous particles further comprise at least one of cerium oxide and copper oxide.
[17]	The combustion promoter according to claim 16, wherein the at least one of cerium oxide and copper oxide is distributed in the microsphere sized porous particle as an eggshell such that a higher concentration of the at least one of cerium oxide and copper oxide is present in the outer region of the microsphere sized porous particle as compared to the concentration of the at least one of cerium oxide and copper oxide in the centre of the microsphere sized porous particle.

Limitation	Claim Language
[18pre]	The combustion promoter according to claim 1, obtained by a process comprising the following steps:
[18a]	introducing a medium in the pores of microsphere sized porous particles having a diameter of less than 1 mm to obtain microsphere sized porous particles with filled pores; and
[18b]	contacting the microsphere sized porous particles with filled pores with an aqueous salt solution of the one or more Group VIII noble metals,
[18c]	wherein the one or more Group VIII noble metals deposits at a higher content in the outer region of the microsphere sized porous particles with filled pores as compared to the content of the one or more Group VIII noble metals in the centre of the microsphere sized porous particles with filled pores, thereby obtaining eggshell particles.
[19]	The combustion promoter of claim 18, the process further comprising a step: (c) at least one of drying and calcining the eggshell particles.
[20]	The combustion promoter according to claim 18, wherein the microsphere sized porous particles having pores filled in step (a) are gamma alumina particles having an average (D50) size of between 60 and 90 microns, have a surface area (BET) of between 50 and 300 m ² /g, and a pore volume of between 0.05 and 0.50 mL/g as measured by the water pore volume.
[21]	The combustion promoter according to claim 18, wherein the medium in step (a) is water.
[22]	The combustion promoter according to claim 18, wherein in step (b) the filled microsphere sized porous particles are contacted in step (b) with a volume of the aqueous salt solution of the one or more Group VIII noble metals which is less than the total volume of the pores of the starting microsphere sized particles.

I. INTRODUCTION

W.R. Grace & Co.-Conn (“Petitioner”) petitions for IPR of claims 1-22 (“Challenged Claims”) of U.S. Patent No. 11,224,864 (“the ’864 Patent”).

II. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the ’864 Patent is available for IPR. Petitioner is not barred or estopped from requesting this review.

B. Challenge and Relief Requested

Petitioner requests IPR of the Challenged Claims on the below grounds.
WRG-1003, ¶¶1-302.

Ground	Claims	Basis for Rejection
1	1, 3, 6-7, 12-19, 21	§103: Miura in view of AAPA
1A	9	§103: Miura in view of AAPA in further view of Vaughn-290
1B	10-11	§103: Miura in view of AAPA in further view of Peters or Vaughn-516
2	1-8, 12-22	§103: Miura plus Baker
2A	9	§103: Miura plus Baker in view of Vaughn-290
2B	10-11	§103: Miura plus Baker in view of Peters or Vaughn-516
3	1-8, 12-22	§103: Lin plus Baker
3A	9	§103: Lin plus Baker in view of Vaughn-290
3B	10-11	§103: Lin plus Baker in view of Peters or Vaughn-516

Ground	Claims	Basis for Rejection
4	1-4, 6, 12-15, 18-19, 21-22	§103: Espinoza in view of AAPA

Each reference pre-dates April 2, 2018 (“Critical Date”), the earliest filed application from which the ’864 Patent claims priority. Petitioner does not take a position whether the ’864 Patent is entitled to priority to the Critical Date, but has applied references that pre-date the Critical Date and qualify as prior art, as shown below.

Reference	Date	Section
Miura	8/23/2007(published)	§102(a)(1)-(2)
Vaughn-290	1/23/2003(issued)	§102(a)(1)-(2)
Peters	3/19/2002(issued)	§102(a)(1)-(2)
Vaughn-516	3/10/2005(published)	§102(a)(1)-(2)
Baker	5/30/2006(issued)	§102(a)(1)-(2)
Lin	8/27/1997(published)	§102(a)(1)-(2)
Espinoza	6/12/2007(issued)	§102(a)(1)-(2)

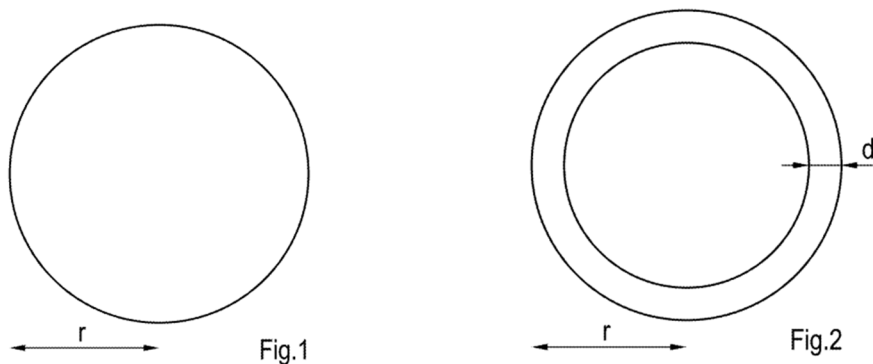
III. SUMMARY OF THE ’864 PATENT

A. Brief Description

The ’864 Patent is directed to “a CO to CO₂ combustion promoter comprising microsphere sized porous silica and/or alumina comprising particles further comprising on[e] or more Group VIII noble metals.” WRG-1001, Abstract. The ’864 Patent discloses “[s]uch CO to CO₂ combustion promoters are well-known and are used in a fluid catalytic cracking (FCC) unit.” *Id.*, 1:26-27. The ’864 Patent discloses “[s]uch CO to CO₂ combustion promoters are commonly

made from impregnation of Group VIII noble metals or metals, commonly platinum and/or palladium, onto a porous alumina and/or other substrate microspheres of average particle size 60 to 90 microns.” *Id.*, 1:62-66. The ’864 Patent explains the “noble metal is distributed in the particle as an eggshell such that a higher content of noble metal is present in the outer region of the particle as compared to the content of noble metal in the center of the particle.” *Id.*, Abstract.

The ’864 Patent describes the “eggshell” as comprising two regions—a first inner region that contains either zero or very low content of the noble metals and a second outer region that contains the noble metals. *Id.*, 2:46-50. The ’864 Patent depicts cross-sections of the state-of-the-art combustion promoter in FIG1 (left) compared to the claimed invention in FIG2 (right). *Id.*, 3:41-44.



B. Prosecution History

The ’864 Patent issued from a continuation of U.S. Application No. 17/043,031 (National Phase Entry of International Application No. PCT/US2019/024742), filed on March 29, 2019, which designates the U.S. and

claims the benefit under 35 U.S.C. §119(e) of Netherlands Provisional Application No. 2020819, filed on April 24, 2018, and U.S. Provisional Application No.

62/651,295, filed on April 2, 2018. The Examiner rejected the claims due to, *inter alia*, the indefiniteness of the term “microsphere sized.” WRG-1002, 62.

Applicant argued “microsphere” is “a term of art, the metes and bound of which are readily understood by one of ordinary skill in the art,” concurrently filing a declaration by Dr. Herring. WRG-1002, 94, 143-44. Applicant amended claim 1 to include “microsphere sized porous particle *having a diameter of less than 1 mm.*” *Id.*, 85.¹ Concurrently, Applicant amended claim 1 to change the claim language from “a higher *content* of the one or more Group VIII noble metal is present in the outer region of the microsphere sized porous particle as compared to the *content* of the one or more Group VIII noble metals in the centre of the microsphere sized porous particle” to instead require a higher *concentration* of the noble metal in the outer region compared to the *concentration* in the center of the particle. *Id.* Applicant clarified that “the distinction between the closest prior art of record and the claimed invention is that the *concentration* (*i.e.*, m/v) of the noble metal as opposed to merely its mass, is not uniform throughout the claimed promoter.” *Id.*, 205. In the Notice of Allowance, the Examiner defined the

¹ Emphasis has been added throughout this petition unless otherwise noted.

claimed invention as requiring “the *concentration, i.e., mass/volume, as opposed to the amount, i.e., mass*, of the claimed noble metal is change[d] from the outer region of the claimed promoter to its inner region.” *Id.*, 212.

C. Level of Ordinary Skill in the Art

A person of ordinary skill in the art relating to the subject matter of the '864 Patent as of the Critical Date (“POSITA”) would have had an advanced degree in a relevant field, such as chemistry, chemical engineering, or material science, with experience working with supported metal catalysts, and had at least 2-3 years of experience with oxidation catalysts and their application. WRG-1003, ¶¶13-14. Work experience can compensate for less formal education, and vice versa. *Id.*

D. Claim Construction

Based on the prior art’s description of the claimed elements being similar to that of the '864 Patent specification, no formal claim constructions are necessary for most of the terms because “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). However, Patent Owner in the co-pending litigation has proposed a construction for the term “concentration” to mean “mass per mass,” contrary to the Notice of Allowance discussed above. WRG-1016. This construction is incorrect in light of the intrinsic record. WRG-1002, 212. Consistent with the intrinsic record, Petitioner proposes “concentration” means

“mass per volume,” as set forth in the Notice of Allowance. However, under either construction, the Grounds presented herein renders obvious the Challenged Claims.

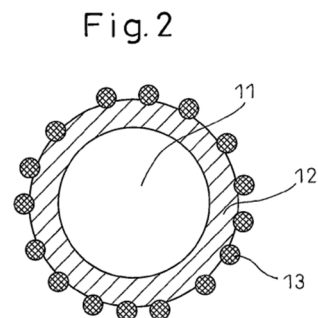
Petitioner is not conceding that each challenged feature satisfies all statutory requirements such as 35 U.S.C. §112 and is not waiving any arguments concerning other grounds or claim scope.

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1] – CLAIMS 1, 3, 6-7, 12-19, & 21 ARE OBVIOUS OVER MIURA IN VIEW OF AAPA²

1. Miura

Miura describes “an exhaust gas purifying catalyst and process for producing a metal oxide particle” wherein the particle comprises “a core part relatively rich in a component originated in a population of first colloid particles and a surface layer relatively rich in a component originated in the population of second colloid particles.” WRG-1004, Abstract, [0014]. Miura describes that the core part of the metal oxide particles may be “relatively rich” in alumina and the surface layer may be “relatively rich” in ceria. *Id.*, [0025]. FIG2 of Miura depicts an embodiment comprising a core part rich in zirconia (11), a surface layer rich in



² Petitioner incorporates this discussion in IV.A.1, 2 into Grounds 1, 1A, & 1B.

ceria (12), and a noble metal, platinum (13), forming the particulate support of the surface layer. *Id.*, FIG2, [0068]. Miura recognizes the “excellent gas purifying performance” achieved. *Id.* See also WRG-1003, ¶¶31, 37, 48, 76-77.

2. Applicant Admitted Prior Art (AAPA)

Admissions by an applicant in the specification and during prosecution constitute “an admission which can be relied upon for both anticipation and obviousness determinations, regardless of whether the admitted prior art would otherwise qualify as prior art under the statutory categories of 35 U.S.C. 102.” MPEP §2129; Guidance on the Treatment of Statements of the Applicant in the Challenged Patent in *Inter Partes* Reviews under §311, June 9, 2022.

Applicant admitted that “CO to CO₂ promoters are ***well known***” and “are ***commonly made*** from impregnation of Group VIII noble metal or metals, commonly platinum and/or palladium, onto a porous alumina and/or other substrate ***microspheres of average particle size 60 to 90 microns.***” WRG-1001, 1:26, 1:62-66; WRG-1002, 94, 143-44; WRG-1003, ¶¶78-79. Applicant need not explicitly identify a disclosure as prior art for the admission to attach. *McCoy v. Heal Sys., LLC*, 850 Fed. App’x 785, 789 (Fed. Cir. 2021). Statements made in the specification and during prosecution relating to microspheres and average particle size constitute AAPA and may be relied upon in an obviousness determination.

3. Analysis

(i) Claim 1

[1pre]:³ To the extent it is limiting, Miura-AAPA renders obvious [1pre]. Miura discloses an exhaust gas purifying catalyst capable of oxidizing CO (*i.e.*, converting CO to CO₂). WRG-1004, Abstract, [0002]; WRG-1003, ¶¶80-81. Miura discloses a range of average particle diameters of the metal oxide particles from 10 µm to less than 50 nm and teaches the benefits of small particle size. *Id.*, [0015], [0068]. Miura discloses a CO to CO₂ combustion promoter including microsphere sized particles having an average diameter size of less than 1mm. WRG-1003, ¶¶80-81. While Miura discloses particle sizes on a different scale of magnitude from the upper range of [1pre], a POSITA would have been familiar with particles sizes in the 1mm and tens of microns range used in combination with combustion promoters. WRG-1003, ¶¶80-81. Indeed, Applicant admitted that microsphere sized particles are well-known in the art. WRG-1001, 1:62-66.

To the extent Miura does not explicitly disclose [1pre], Applicant admitted that CO to CO₂ combustion promoters were well-known in the art and “are commonly made from impregnation of Group VIII noble metal or metals, commonly platinum and/or palladium, onto a porous alumina and/or other

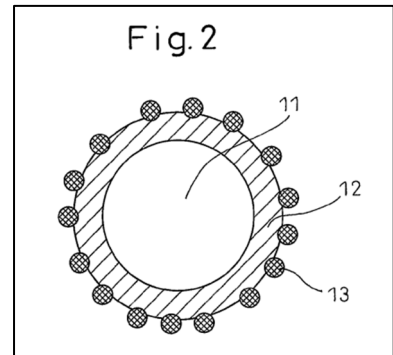
³ Petitioner reserves all rights to challenge the claims under 35 U.S.C. §112.

substrate microspheres of average particle size 60 to 90 microns,” WRG-1001, 1:62-2:3, and particles having an average diameter size of less than 1mm, like those disclosed in Miura, were known for use in CO to CO₂ combustion promoters. Applicant admitted during prosecution that a POSITA would have been familiar with “microspheres” as “*spherical particles as small as 1 micron in diameter and as large as 1,000 microns (1 mm).*” WRG-1002, 94. A POSITA would have been motivated to use particles less than 1mm in diameter in a CO to CO₂ combustion promoter. WRG-1003, ¶¶80-81.

[1a]: Miura discloses [1a]. Miura discloses “a metal oxide particle comprising a core part relatively rich in a component originated in the population of first colloid particles” wherein the “population of first colloid particles” may be alumina particles and, specifically, *γ-alumina* particles. WRG-1004, [0002], [0014], [0023]-[0026]. Miura discloses that the “metal oxide support may be formed of various materials but, in order to obtain a large surface area, *alumina* (Al₂O₃) has been heretofore generally used.” *Id.*, [0003].

Applicant admitted that CO to CO₂ combustion promoters were known in the art and are commonly made on porous alumina substrates. WRG-1001, 1:62-2:3; WRG-1003, ¶¶82-83.

[1b]: Miura discloses [1b]. Miura discloses “a metal oxide particle comprising a core part [11, shown in FIG2] relatively rich in a component originated in the population of first colloid particles and a surface layer [12, shown in FIG2] relatively rich in a component originated in the population of second colloid particles can be obtained;” and Miura discloses that the metal oxide particle is porous. WRG-1004, [002], [0014], FIG2. Miura discloses that the surface layer 12 is relatively rich in particles “selected from the group consisting of alumina, ceria, zirconia and titania colloid particles,” and may particularly be ceria. *Id.*, [0023]-[0026], FIG2. Miura notes that “relatively rich” describes the composition of the core part and surface layer is used with respect to the molar fraction based on the total molar number of metals in each of the core part and the surface layer. *Id.*, [0016]. See WRG-1003, ¶¶84-86.



Miura discloses that a “noble metal [13, shown in FIG2] such as platinum, rhodium and palladium is supported on the metal oxide particle. . . [and] mainly on the surface layer [12].” WRG-1004, [0048], [0072], FIG2. Miura discloses an embodiment wherein a “noble metal such as platinum, rhodium and palladium is supported on the metal oxide particle” and “[t]he noble metal to be supported is preferably at least one selected from the group consisting of Pt, Pd, Rh, Ir and Au.” *Id.*, [0048], [0068], [0072]; WRG-1003, ¶87.

Miura discloses that “[t]he noble metal may be loaded on the metal oxide particle by any known method, for example, by a method of impregnating metal oxide particles with a solution containing a salt and/or a complex salt of noble metal.” *Id.*, [0049]. Miura discloses that “[t]he amount of the noble metal supported on the metal oxide particle may be from 0.01 to 5 mass %, particularly from 0.1 to 2 mass % based on the metal oxide particle.” *Id.* A POSITA would have understood that the noble metal loaded on the metal oxide particle would disperse into the surface layer [12] or outer shell because the particle is porous. *Id.*, [0002]; WRG-1003, ¶¶87-88. Miura depicts this resulting structure—referred to in the art as an “eggshell”—in FIG2, depicting a surface layer (12) of particulate support comprising CeO₂ and a noble metal (13), such as platinum, which covers an entire core part (11) itself formed of ZrO₂ or, alternatively, alumina. WRG-1004, FIG2, [0068], [0023]-[0026]; WRG-1003, ¶88. A POSITA would have understood that not only is the content (mass) of the noble metal higher in the outer region [12] compared to the inner region [11] but also the concentration (mass/volume) and/or weight percentage (mass/mass) of noble metal is higher in the outer region compared to the inner region. WRG-1003, ¶¶88. Miura provides several examples wherein the noble metal Pt (1% by weight) is incorporated into the surface layer composed of CeO₂ and the core part composed of ZrO₂, lacks any content or concentration of Pt. WRG-1004, [0098]-[0140]. In

this manner, as shown and described with respect to FIG2, Miura teaches or suggests that the noble metals are distributed in the particle as an eggshell such that a higher concentration of the noble metals is present in the outer region as compared to the concentration of the noble metals in the center of the particle. WRG-1003, ¶¶88-89.

(ii) Claim 3

Miura discloses claim 3. Miura discloses alumina. WRG-1004, [0003], [0014], [0023]-[0026]; *supra* IV.A.3.(i); WRG-1003, ¶¶90-91.

(iii) Claim 6

Miura-AAPA renders obvious claim 6. Miura discloses eggshell catalyst particles having an average diameter size less than 1mm. WRG-1004, [0015], FIG2, [0068]; *supra* IV.A.3.(i); WRG-1003, ¶¶92-93. To the extent, Miura does not explicitly disclose [6], Applicant admitted that CO to CO₂ combustion promoters were well-known in the art and were “commonly made from impregnation of Group VIII noble metal or metals, commonly platinum and/or palladium, onto a porous alumina and/or other substrate *microspheres of average particle size 60 to 90 microns.*” WRG-1001, 1:62-2:3. A POSITA would have known that particles having an average size of between 60 and 90 microns were known for use in CO to CO₂ combustion promoters like those disclosed in Miura. WRG-1003, ¶¶92-93. Applicant admitted during prosecution that a POSITA

would have been familiar with “microspheres” as “spherical particles as small as 1 micron in diameter and as large as 1,000 microns (1 mm).” WRG-1002, 94.

A POSITA would have recognized that the microsphere-sized particles taught by Miura may have an average particle diameter size of between 60 and 90 microns and would be motivated to apply those particles to the “eggshell” structure taught by Miura. WRG-1003, ¶¶92-93. A POSITA would have been motivated to combine AAPA with Miura because Miura recognizes that a substantially uniform metal oxide particle does not always yield the best results. WRG-1004, FIG2, [0009], [0068]; WRG-1003, ¶¶92-93. Each of the ’864 Patent and Miura teaches the “eggshell” structure having a core part and surface layer, as described in [1b], is preferred to a uniform structure. WRG-1004, FIG2, [0009], [0068]. A POSITA would have been motivated to combine the “eggshell structure,” as described by Miura, with the particle size admittedly known in the art. WRG-1003, ¶¶92-93.

(iv) Claim 7

Miura discloses claim 7 by disclosing γ -alumina. WRG-1004, [0002]; *supra* IV.A.3.(i); WRG-1003, ¶94.

(v) Claim 12

Miura discloses claim 12 by disclosing platinum, rhodium, palladium, and iridium. WRG-1004, [0002], [0048], [0068], [0072]; *supra* IV.A.3.(i); WRG-1003, ¶95.

(vi) Claim 13

Miura discloses claim 13 by disclosing platinum and palladium. WRG-1004, [0002], [0048], [0068], [0072]; *supra* IV.A.3.(i); WRG-1003, ¶96.

(vii) Claim 14

Miura discloses claim 14 by disclosing platinum. WRG-1004, [0002], [0048], [0068], [0072]; *supra* IV.A.3.(i); WRG-1003, ¶97.

(viii) Claim 15

Miura discloses claim 15 by disclosing palladium. WRG-1004, [0002], [0048], [0068], [0072]; *supra* IV.A.3.(i); WRG-1003, ¶98.

(ix) Claim 16

Miura discloses claim 16 by disclosing cerium oxide. WRG-1004, [0014], [0016], [0023]-[0026], FIG2, [0068]; *supra* IV.A.3.(i); WRG-1003, ¶99.

(x) Claim 17

Miura discloses claim 17 by disclosing an eggshell catalyst structure comprising a higher concentration of cerium oxide as part of the surface layer as compared to the concentration of cerium oxide in the center of the particle. WRG-1004, [0023]-[0026], FIG2, [0068]; *supra* IV.A.3.(i); WRG-1003, ¶100.

(xi) **Claim 18⁴**

[18pre]: To the extent the preamble is limiting, Miura-AAPA renders obvious [18pre]. *Supra* IV.A.3.(i); WRG-1003, ¶¶101-102.

[18a]: Miura-AAPA renders obvious [18a] by disclosing eggshell catalyst particles having an average diameter size of less than 1mm. WRG-1004, [0015], FIG2, [0068]; *supra* IV.A.3.(i); WRG-1003, ¶¶103-104. Miura discloses methods of loading the metal oxide particle, including impregnation of a salt solution of the noble metal. *Id.*, [0049], [0072], [0101]; WRG-1003, ¶¶103-104.

A POSITA would have combined Miura with AAPA to apply the teachings of Miura to the full range of microsphere sized particles. *Supra* IV.A.3.(i); WRG-1003, ¶¶103-104.

[18b]: Miura discloses [18b] by disclosing known methods of loading the noble metal on the metal oxide particle. WRG-1004, [0049], FIG2, [0068], [0072]. Miura discloses that the particulate supports were “dispersed in distilled water” to which “an *aqueous dinitrodiamine platinum solution* (Pt content: 4.4% by weight) was added thereto.” *Id.*, [0101]. Miura discloses or at least suggests to a POSITA that the obtained particulate supports are first dispersed in distilled water

⁴ Miura-AAPA renders obvious claim 18 because the combination renders obvious claim 1. MPEP §2113.

such that the particulate supports are filled with water, and then contacted with an aqueous salt solution containing a noble metal, such as platinum. *Id.*, [0101]; WRG-1003, ¶105.

[18c]: Miura discloses [18c]. *Supra* IV.A.3.(i); WRG-1003, ¶106.

(xii) Claim 19

Miura discloses claim 19 by disclosing known methods of loading the noble metal on the metal oxide particle “*followed by stirring, drying and further firing.*” WRG-1004, FIG2, [0068], [0072]; *id.*, [0049], [0101]; WRG-1003, ¶107.

(xiii) Claim 21

Miura discloses claim 21 by disclosing known methods of loading the noble metal on the metal oxide particle including “dispersing the particulate support in *distilled water.*” WRG-1004, FIG2, [0068], [0072]; *id.*, [0049], [0101]; WRG-1003, ¶108.

**B. [GROUND 1A] – CLAIM 9 IS OBVIOUS OVER MIURA
IN VIEW OF AAPA AND IN VIEW OF VAUGHN 290⁵**

1. Vaughn-290

Vaughn-290 is directed to “a catalyst which contains molecular sieve-containing attrition particles and virgin molecular sieve, the attrition particles having been recycled from a catalyst manufacture process or from a reaction

⁵ Petitioner incorporates this discussion in IV.B.1, 2 into Ground 1A.

system.” WRG-1005, 1:7-13. Vaughn-290 teaches that the disclosed catalyst may be used in a variety of catalytic reaction processes such that the recycled catalyst particles can be used to form a catalytic composition. *Id.*, Abstract, 2:43-45; WRG-1003, ¶¶44-46, 64-67, 110. A POSITA would have recognized the variety of catalytic reaction processes as including a CO to CO₂ combustion promoter. WRG-1003, ¶¶44-46, 64-67, 110.

2. Miura-AAPA-Vaughn-290⁶

Miura discloses an exhaust gas purifying catalyst capable of oxidizing CO wherein the particle comprises a core and a surface layer containing noble metal. WRG-1004, Abstract, [0014]. Vaughn-290, similar to Miura and AAPA, discloses a catalyst for use in a variety of catalytic reaction processes, and a POSITA would have recognized the variety of catalytic reaction processes as including a CO to CO₂ combustion promoter. WRG-1005, Abstract, 2:43-45; WRG-1003, ¶¶44-46, 64-67, 111-114. Vaughn-290 discloses *recycled* particles that “are actually molecular sieve-containing catalyst particles that have be [sic] used in a functioning manufacture or reaction system, and have been reduced in size due to attrition.” WRG-1005, 9:55-65. Vaughn-290 discloses that the “catalyst fines are

⁶ “The motivation to combine is a flexible one.” *Intel Corp. v. PACT XPP Schweiz, AG*, No. 2022-1037, slip at *10 (Fed. Cir. March 13, 2023).

recovered from the manufacture or reaction system and are recycled back into the catalyst manufacturing scheme. The catalyst fines, therefore, are incorporated into the finished catalyst particles.” WRG-1005, 9:55-65, 16:26-35; WRG-1003, ¶¶44-46, 64-67, 111-114. While Miura does not disclose an equilibrium or spent catalyst, a POSITA would have understood that “the recovery and use of the attrition particles in [a] catalyst is beneficial in minimizing waste, thereby reducing problems relating to both environmental and economic constraints.” WRG-1005, Abstract; WRG-1003, ¶¶44-46, 64-67, 111-114.

A POSITA would have recognized the efficiencies and benefits of recycling catalyst material taught by Vaughn-290 in combination with Miura’s eggshell catalyst. WRG-1003, ¶¶44-46, 64-67, 111-114. A POSITA would have been prompted to pursue the efficiencies of Vaughn-290 as doing so is merely the application of known techniques (recycling particles) to a known structure (the combustion promoter particles) to yield predictable results (minimizing waste). WRG-1003, ¶¶44-46, 64-67, 111-114; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have expected success in the Miura-AAPA-Vaughn-290 combination given that each describes catalyst for use in a variety of catalytic reaction processes, including the well-known CO to CO₂ combustion promotion process. WRG-1004, Abstract, [0014]; WRG-1005, Abstract, 2:43-45; WRG-1003, ¶¶44-46, 64-67, 111-114.

3. Analysis

(i) Claim 9

Miura-AAPA-Vaughn-290 renders obvious claim 9. Miura-AAPA renders obvious claim 1. *Supra* IV.A.3.(i). Vaughn-290 discloses recycled molecular sieve-containing catalyst particles. WRG-1005, 9:55-65, 16:26-35. The recycled catalyst disclosed in Vaughn-290 is a spent catalyst as described by the '864 Patent. WRG-1001, 4:47-53; WRG-1003, ¶115. Vaughn-290 teaches recovery and recycling of spent catalyst back to a catalyst manufacturing process such that the spent catalyst may be incorporated into the manufacture of additional catalyst particles, such as those disclosed by Miura and AAPA. WRG-1005, 9:55-65, 16:26-35; WRG-1003, ¶115.

C. [GROUND 1B] – CLAIMS 10-11 ARE OBVIOUS OVER MIURA IN VIEW OF AAPA AND IN FURTHER VIEW OF PETERS OR, ALTERNATIVELY, VAUGHN 516⁷

1. Peters

Peters is directed to “compositions suitable for use in FCC processes which are capable of promoting CO combustion while avoiding significant NO_x formation.” WRG-1006, 1:49-60. Peters discloses combustion particles comprising “a component containing (i) an acidic oxide support, (ii) an alkali metal and/or alkaline earth metal or mixtures thereof, (iii) a transition metal oxide having

⁷ Petitioner incorporates this discussion in IV.C.1-4 into Ground 1B.

oxygen storage capability, and (iv) palladium.” *Id.* Peters discloses that the acidic oxide support is preferably silica alumina and the preferred oxygen storage oxide is ceria. *Id.* See also WRG-1003, ¶¶56, 117

2. Miura-AAPA-Peters

Miura discloses an exhaust gas purifying catalyst capable of oxidizing CO wherein the particle comprises a core and a surface layer containing noble metal. WRG-1004, Abstract, [0014]. Miura does not expressly disclose an attrition index of the metal oxide particles, though a POSITA would have understood that catalyst material should be durable and attrition-resistant and a low attrition index is desirable, while reducing NO_x emissions. WRG-1003, ¶¶68-71, 118-122.

Peters discloses promoting CO combustion while avoiding significant NO_x formation. WRG-1006, 1:49-60. Miura and Peters teach the use of similar components, namely, the use of ceria as the preferred oxide component as the outer layer (most susceptible to attrition) of the eggshell structure disclosed by Miura. WRG-1004, [0068]; WRG-1006, 1:49-60; WRG-1003, ¶¶68-71, 118-122. While Miura is silent as to the attrition index, Peters explicitly identifies the attrition index value. WRG-1006, 3:9-20.

By incorporating the specific attrition index teachings of Peters to Miura-AAPA, a POSITA would have recognized that the attrition index value of Miura, using the same cerium oxide as the outer layer of the combustion particles, would

have been similar or equivalent to the values disclosed in Peters. WRG-1003, ¶¶68-71, 118-122. A POSITA would have been prompted to pursue the optimal attrition index of the combustion promoter particles, as doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶68-71, 118-122; WRG-1001, 6:53-63; *KSR*, 550 U.S. at 417. A POSITA would have had a reasonable expectation of success in the Miura-AAPA-Peters combination given that both describe using cerium oxide as the preferred metal oxide component of the combustion promoter. WRG-1004, [0068]; WRG-1006, 1:49-60; WRG-1003, ¶¶68-71, 118-122.

3. Vaughn-516

Vaughn-516 is directed to processes for removing undesirably sized catalyst particles from a catalyst synthesis system; in particular, Vaughn-516 discloses a molecular sieve to obtain a slurry of optimally-sized catalyst particles. WRG-1007, Abstract. Vaughn-516 teaches that the benefit of the disclosed processes is to obtain a formulated catalyst mixture with desirable catalytic activity characteristics for use in a reaction system. *Id*; *see also* WRG-1003, ¶55, 123.

4. Miura-AAPA-Vaughn-516

Miura discloses an exhaust gas purifying catalyst capable of oxidizing CO wherein the particle comprises a core and a surface layer containing noble metal.

WRG-1004, Abstract, [0014]. A POSITA would have recognized that Miura teaches that the core part of the particle does not contain or has a low concentration of the noble metal component, specifically platinum and palladium, that are present on the surface of the particle. *Id.*, [0048], [0072], FIG2; WRG-1003, ¶¶124-128, 72-74. Miura does not expressly disclose an attrition index of the metal oxide particles, though a POSITA would have understood that catalyst material should be durable and attrition-resistant and a low attrition index is desirable, while reducing NO_x emissions. WRG-1003, ¶¶124-128, 72-74.

Vaughn-516 discloses processes to obtain catalyst particles with optimal properties, *e.g.*, size. WRG-1007, Abstract. Vaughn-516 teaches that the benefit of the disclosed processes is to obtain a formulated catalyst mixture with desirable catalytic activity characteristics for use in a reaction system. *Id.* Vaughn-516, similar to Miura, teaches the use of similar catalytic components of the catalyst particles, namely, the use of Group VIII metals, including platinum and palladium, in similar distribution to Miura's eggshell structure. WRG-1007, [0108], [0164]; WRG-1004, [0048], [0072], FIG2; WRG-1003, ¶¶124-128, 72-74. Vaughn-516 specifically teaches that the concentration of the Group VIII metal is low in the support material and this design choice is effective in reducing overall catalyst cost and "increasing catalyst strength such as crush strength and attrition resistance." WRG-1007, [0106], [0108], [0164]. And, while Miura is silent as to the attrition

index, Vaughn-516 explicitly identifies the attrition index value of the combustion promoter composition. WRG-1007, [0131].

By combining the specific attrition index teachings of Vaughn-516 with Miura-AAPA, a POSITA would have recognized that the attrition index value of Miura, using the same catalytic components with similar distributions within the combustion particles, would have been similar or equivalent to the values disclosed in Vaughn-516. WRG-1003, ¶¶124-128, 72-74. A POSITA would have been led to pursue the optimal attrition index of the combustion promoter particles because doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶124-128, 72-74; WRG-1001, 6:53-63; *KSR*, 550 U.S. at 417. A POSITA would have had a reasonable expectation of success in the Miura-AAPA-Vaughn-516 combination given that Miura and Vaughn-516 describe using the same catalytic components with similar distributions within the combustion particles. WRG-1004, [0068]; WRG-1007, [0086]; WRG-1003, ¶¶124-128, 72-74.

5. Analysis

(i) Claim 10⁸

Miura-AAPA-Peters or Miura-AAPA-Vaughn-516 renders obvious claim 10. Miura-AAPA renders obvious claim 1. *Supra* IV.A.3.(i).

Peters discloses a combustion promoter for use in FCC catalytic processes such that when the promoter is used as an additive particulate, the *average particle size is 20-200 microns* and the attrition value of the additive particles measured by the *Davison attrition index (DI) is “about 0-45, more preferable about 0-15.”*

WRG-1006, 3:9-20. A POSITA would have recognized that the ASTM D-5757 value disclosed in the '864 Patent is comparable to the DI value used in Peters.

WRG-1003, ¶¶129-133; WRG-1010. A POSITA would have recognized that Peters teaches an overlap of the claimed average particle size (40-105 microns) and claimed attrition value (10-20 or, preferably, 10-15) and renders obvious claim 10.

WRG-1003, ¶¶129-133.

Vaughn-516 discloses obtaining a catalytic composition containing a molecular sieve wherein the attrition resistance of the composition is measured using an Attrition Rate Index (ARI) using a hardened steel attrition cup. WRG-1007, [0130]. Vaughn-516 teaches a catalyst composition of an *average particle*

⁸ Petitioner reserves all rights to challenge the claim under 35 U.S.C. §112.

size from 53 to 125 microns and “an ARI less than 15 weight percent per hour, preferably less than 10 weight percent per hour, more preferably less than 5 weight percent per hour.” *Id.*, [0131]. A POSITA would have recognized that the ASTM D-5757 value disclosed in the ’864 patent is comparable to the ARI value used in Vaughn-516. WRG-1003, ¶¶129-133; WRG-1010. A POSITA would have recognized Vaughn-516 teaches an overlap of the claimed average particle size (53-105 microns) and claimed attrition value (10-15) and renders obvious claim 10. WRG-1003, ¶¶129-133.

(ii) Claim 11⁹

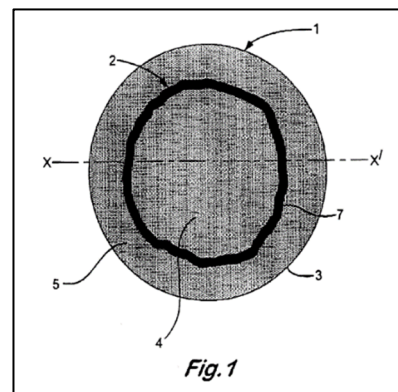
Miura-AAPA-Peters or Miura-AAPA-Vaughn-516 renders obvious claim 11. Miura-AAPA renders obvious claim 1. *Supra* IV.A.3.(i). Miura-AAPA-Peters or Miura-AAPA-Vaughn-516 renders obvious combustion promoter particles between 40 and 105 microns with an attrition index between 10 and 20. *Supra* IV.C.5.(i). WRG-1003, ¶¶134-136.

⁹ Petitioner reserves all rights to challenge the claim under 35 U.S.C. §112.

**D. [GROUND 2] – CLAIMS 1-8 & 12-22 ARE OBVIOUS
OVER MIURA IN VIEW OF BAKER¹⁰**

1. Baker

Baker is directed to a “catalyst composition comprising support particles having at least one catalytically active metal distributed therein” wherein the “catalyst composition [is] suitable for the manufacture of vinyl acetate may also comprise . . . promoters.” WRG-1008, 1:60-67, 4:66-5:12. Baker teaches that the active metal is a Group VIII noble metal, which “is distributed in the support particle . . . between an inner and an outer region of said support particle” such that the inner region has a lower concentration of the Group VIII noble metal, as shown in FIG1. *Id.*; *id.*, FIG1, 7:35-53. Baker teaches a ***non-uniform*** particle wherein the concentration of noble metal is lowest at the center “inner region” of the particle and the concentration of noble metal increases radially to the outer edge (7) relative to the inner region (4). *Id.*



WRG-1003, ¶¶36, 43, 49, 138-140.

2. Miura-Baker

Miura discloses an exhaust gas purifying catalyst capable of oxidizing CO. WRG-1004, Abstract, [0002]. Miura teaches an “eggshell” structure of the catalyst

¹⁰ Petitioner incorporates this discussion IV.D.1, 2 into Grounds 2, 2A, & 2B.

wherein the surface layer of particulate support comprises CeO_2 , which covers an entire core part formed of ZrO_2 , and a noble metal, such as platinum, is supported on the particulate support. *Id.*, FIG2, [0068].

Miura discloses a range of average particle diameters of the metal oxide particles from 10 μm to less than 50 nm, and teaches the benefits of small particle size. *Id.*, [0015], [0068]. Miura discloses particles having an average diameter size of less than 1mm. WRG-1003, ¶¶141-145, 58-59. However, Miura does not expressly teach the full range of the claimed particle size. A POSITA still would have appreciated that Miura teaches benefits of using small particle size in the disclosed combustion promoter. WRG-1004, [0068]; WRG-1003, ¶¶141-145, 58-59. A POSITA would have considered using the disclosed particle sizes taught by Baker. WRG-1003, ¶¶141-145, 58-59.

Baker discloses a catalyst composition comprising support particles having at least one catalytically active metal distributed therein. WRG-1008, 1:60-67, 4:66-5:12. Baker discloses a non-uniformly distributed metal catalyst structure, which discloses a lower concentration of metal in the center of the particle. Baker teaches that the Group VIII noble metal “is distributed in the support particle . . . between an inner and an outer region of said support particle” such that the inner region has a lower concentration of the Group VIII noble metal than the outer region. *Id.*, 1:60-67, 4:39-47. WRG-1003, ¶¶138-140.

As to the average particle size, Baker teaches that the support particles are “microspheroidal.” *Id.*, 3:34-46. Baker specifically teaches that the catalyst has the following particle size distribution:

0 to 20 microns	0-30 wt %
20 to 44 microns	0-60 wt %
44 to 88 microns	10-80 wt %
88 to 106 microns	0-80 wt %
>106 microns	0-40 wt %
>300 microns	0-5 wt %

id., 3:16-33 (laser diffraction), wherein the average particle size is approximately 73 microns. WRG-1003, ¶¶36, 144. Baker teaches microsphere sized porous particles having an average diameter size of less than 1mm. A POSITA would have recognized the particles with an average size less than 1mm may be used in conjunction with the combustion promoter of Miura. *Id.* Miura and Baker teach similar components, including silica, aluminum, and Group VIII metals, and Miura teaches benefits of small particle diameter. WRG-1004, [0068]; WRG-1003, ¶¶141-145, 58-59. By incorporating the specific particle size ranges of Baker into Miura, a POSITA would have recognized that the properties of Miura’s combustion promoter can be improved through the specific particle size teachings of Baker. WRG-1003, ¶¶141-145, 58-59.

A POSITA would have been prompted to pursue this implementation of Baker’s specific particle size into Miura’s catalyst because doing so is merely the application of known techniques (using small particles) to a known structure

(combustion promoter material) to yield predictable results (improved performance). WRG-1003, ¶¶141-145, 58-59; *KSR*, 550 U.S. at 417. And a POSITA would have had a reasonable expectation of success in the Miura-Baker combination given that Miura and Baker describe using sub-1mm particles for improved catalytic performance. WRG-1003, ¶¶141-145, 58-59.

3. Analysis

(i) Claim 1

[1pre]: To the extent it is limiting, Miura-Baker renders obvious [1pre]. Miura discloses [1pre]. WRG-1004, Abstract, [0002], [0015], [0068]; *supra* IV.A.3.(i). However, Miura does not expressly teach the full range of the claimed particle size.

Baker discloses a “catalyst composition comprising support particles having at least one catalytically active metal distributed therein,” wherein the “catalyst composition suitable for the manufacture of vinyl acetate may also comprise . . . promoters.” WRG-1008, 1:60-67, 4:66-5:12. Baker teaches that the support particles are “microspheroidal.” *Id.*, 3:34-46. Baker specifically teaches that the catalyst has the following particle size distribution:

0 to 20 microns	0-30 wt %
20 to 44 microns	0-60 wt %
44 to 88 microns	10-80 wt %
88 to 106 microns	0-80 wt %
>106 microns	0-40 wt %
>300 microns	0-5 wt %

id., 3:16-33, wherein the average particle size is approximately 73 microns. WRG-1003, ¶36. Baker teaches microsphere sized porous particles having an average diameter size of less than 1mm. WRG-1003, ¶¶146-147.

[1a]: As described above, Miura discloses [1a]. *Supra* IV.A.3.(i). Baker discloses [1a]. Baker discloses a catalyst composition comprising support particles having at least one catalytically active metal distributed therein where “***silica-based support particles*** are the most preferred.” WRG-1008, 1:60-67, 4:8-36. Baker teaches that the support particles include “***alumina, silica-alumina***, ceria, magnesia, titania, zirconia and mixed oxides and mixtures thereof.” *Id.*; *id.*, 1:12-22. Baker discloses that “microspheroidal particles are produced by ***spray drying a mixture of a silica sol with silica particles*** followed by drying and calcining.” WRG-1008, 2:63-3:10, 3:40-45; *id.*, 7:56-67. WRG-1003, ¶¶148-149.

[1b]: As described above, Miura discloses [1b]. *Supra* IV.A.3.(i); WRG-1003, ¶150.

(ii) Claim 2

Baker discloses claim 2 by disclosing silica. WRG-1008, 1:60-67, 4:8-36; *supra* IV.D.3.(i); WRG-1003, ¶¶151.

(iii) Claim 3

Miura discloses claim 3. *Supra* Section IV.A.3.(i). Baker discloses claim 3. Baker discloses alumina. WRG-1008, 1:60-67, 4:8-36; *id.*, 1:12-22; *supra* IV.D.3.(i); WRG-1003, ¶¶152-153.

(iv) Claim 4

Baker discloses claim 4 by disclosing silica, alumina, and mixtures thereof. WRG-1008, 1:12-22, 1:60-67, 4:8-36; *supra* IV.D.3.(i); WRG-1003, ¶154.

(v) Claim 5

Baker discloses claim 5 by disclosing silica and alumina. WRG-1008, 1:12-22, 1:60-67, 4:8-36; *supra* IV.D.3.(i); WRG-1003, ¶155.

(vi) Claim 6

Baker discloses claim 6 by teaching an average (D50) size of between 60 and 90 microns. WRG-1008, 1:60-67, 2:41-58, 3:16-46, 7:35-53; *supra* IV.D.3.(i); WRG-1003, ¶156.

(vii) Claim 7

Miura discloses claim 7. *Supra* IV.A.3.(i); WRG-1003, ¶157.

(viii) Claim 8

Baker discloses claim 8 by disclosing spray dried silica particles. WRG-1008, 2:63-3:10, 3:40-45, 7:56-67; *supra* IV.D.3.(i); WRG-1003, ¶158.

(ix) Claim 12

Miura discloses claim 12. *Supra* IV.A.3.(i). Baker discloses claim 12. Baker teaches that Group VIII noble metals comprising the catalytically active metal are “*palladium, platinum, rhodium, ruthenium.*” WRG-1008, 1:60-67, 4:39-47; *id.*, 1:12-22; WRG-1003, ¶¶159-160.

(x) Claim 13

Miura discloses claim 13. *Supra* IV.A.3.(i). Baker discloses claim 13. Baker discloses palladium and platinum. WRG-1008, 1:60-67, 4:39-47; *supra* IV.D.3.(ix); WRG-1003, ¶¶161-162.

(xi) Claim 14

Miura discloses claim 14. *Supra* IV.A.3.(i). Baker discloses claim 14. Baker discloses platinum. WRG-1008, 1:60-67, 4:39-47; *supra* IV.D.3.(ix); WRG-1003, ¶¶163-164.

(xii) Claim 15

Miura discloses claim 15. *Supra* IV.A.3.(i). Baker discloses claim 15. Baker discloses palladium. WRG-1008, 1:12-22, 1:60-67, 4:39-47; *supra* IV.D.3.(ix); WRG-1003, ¶¶165-166.

(xiii) Claim 16

Miura discloses claim 16. *Supra* IV.A.3.(i). Baker discloses claim 16. Baker discloses catalyst composition comprising support particles including “alumina, silica-alumina, *ceria*, magnesia, titania, zirconia and *mixed oxides* and

mixtures thereof,” and other oxides may be used including “other metals such as gold, *copper*, *cerium* and mixtures thereof.” *Id.*, 1:60-67, 4:8-47, 4:66-5:12. A POSITA would have understood the scope of Baker to include support particles comprising cerium oxide and copper oxide. WRG-1003, ¶¶167-168.

(xiv) Claim 17

Miura discloses claim 17. *Supra* IV.A.3.(i); WRG-1003, ¶169.

(xv) Claim 18¹¹

[18pre]: Miura discloses [18pre]. *Supra* IV.A.3.(xi); WRG-1003, ¶170.

[18a]: Miura-Baker renders obvious [18a]. *Supra* IV.A.3.(xi) and IV.D.3.(i). Baker discloses that the “catalytically active metal(s) may be impregnated in one or more steps onto the support particles in the form of precursor salt solutions” wherein the preferably medium is a palladium compound in a suitable solvent, such as water, carboxylic acids, alcohols, nitriles, or chlorinated solvents. WRG-1008, 4:48-65; WRG-1003, ¶¶171-172.

[18b]: Miura discloses [18b]. *Supra* IV.A.3.(xi). Baker discloses [18b]. Baker discloses that the “catalytically active metal(s) may be impregnated in one or more steps onto the support particles in the form of precursor *salt solutions*”

¹¹ Miura-Baker renders obvious claim 18 because the combination renders obvious claim 1. *See* MPEP §2113.

wherein the preferably medium is a *palladium compound in a suitable solvent.*”

WRG-1008, 4:48-65. Baker discloses that the pores may be filled repeatedly with salt solution to achieve the desired level of metal in the impregnated particles. *Id.* at 5:42-65. WRG-1003, ¶¶173-174.

[18c]: Miura discloses [18c]. *Supra* IV.A.3.(xi); WRG-1003, ¶175.

(xvi) Claim 19

Miura discloses claim 19. *Supra* IV.A.3.(xii). Baker discloses claim 19. Baker discloses that the “*impregnated support particles may optionally be dried.*” WRG-1008, 5:55-65; WRG-1003, ¶¶176-177.

(xvii) Claim 20

Miura-Baker renders obvious claim 20. First, Miura-Baker teach the claimed particles. Miura discloses γ -alumina. WRG-1004, [0002]; *supra* IV.A.3.(i). Baker teaches an average (D50) size of between 60 and 90 microns. *Supra* IV.D.3.(i). A POSITA would have recognized that the γ -alumina particles with an average particle size between 60 and 90 microns may be used. A POSITA would have been motivated to combine the small γ -alumina particles, as described by Miura, with the average particle size distribution disclosed by Baker. WRG-1003, ¶¶178-180.

Baker discloses the claimed surface area. Baker discloses the surface area of support particles is typically “about 50 m²/g and may range up to about 200 m²/g

. . . and may range up to about 800 m²/g.” WRG-1008, 3:41-51, 4:18-28. A

POSITA would have recognized that Baker teaches a complete overlap with the claimed surface area. WRG-1003, ¶¶178-180.

Baker discloses the claimed pore volume. Baker discloses that a “typically suitable microspheroidal support particle has a pore volume (measured by nitrogen sorption) between about 0.2 and 0.7 cc/g.” *Id.*, 3:41-51, 4:18-28. A POSITA would have understood that the volume measurement cc/g is equivalent to mL/g. A POSITA would have recognized that Baker teaches an overlap of the claimed pore volume. WRG-1003, ¶¶178-180.

(xviii) Claim 21

Miura discloses claim 21. *Supra* IV.A.3.(xiii). Baker discloses claim 21. Baker discloses impregnating the support particles in a suitable solvent wherein “[p]referably, the solvent is water.” WRG-1008, 4:48-65; WRG-1003, ¶¶181-182.

(xix) Claim 22

Miura-Baker renders obvious claim 22. Baker discloses impregnating the particles in a *palladium compound in a suitable solvent*. WRG-1008, 4:48-65; *supra* IV.D.3.(xv). Baker teaches that a “preferable method to impregnate salt solutions is an incipient wetness technique in which there is used a salt solution in an amount *up to the volume of the pores* of the support particles *without excess solution being used*.” *Id.*, 5:42-54. Baker explains the goal of this method to

obtain a “desirable level of metal compounds, such as palladium” incorporated into the support particles on the outer edge (7) below the particle surface (3), as depicted in FIG1. *Id.*, 5:42-54, 7:35-53. A POSITA would have understood that to incorporate a desirable level of metal compound into the support particle, the salt solution must be up to or less than the total volume of the pores of the starting microsphere sized particles. A POSITA would have understood the deviating from the teaching of Baker and using excess solution more than the total volume of the pores would prevent the deposition of the metal compound on the outer edge of the support particle. A POSITA would have recognized that Baker teaches a range of volume of salt solution that is less than or equal to the pore volume of the particles. WRG-1003, ¶183.

**E. [GROUND 2A] – CLAIM 9 IS OBVIOUS OVER MIURA
IN VIEW OF BAKER AND IN FURTHER VIEW OF
VAUGHN 290¹²**

1. Miura-Baker-Vaughn-290

A POSITA would have been motivated to combine the recycling process of Vaughn-290 to the combination of Miura-Baker. *Supra* IV.B.2. Baker discloses a non-uniform structure similar to that of Miura, *supra* IV.D.1, wherein the catalyst comprises at least one catalytically active metal distributed therein. WRG-1008,

¹² Petitioner incorporates this discussion in IV.E.1 into Ground 2A.

1:60-67, 4:66-5:12. Vaughn-290 discloses a catalyst for use in a variety of catalytic reaction processes, and a POSITA would have recognized the variety of catalytic reaction processes as including a CO to CO₂ combustion promoter. WRG-1005, Abstract, 2:43-45; WRG-1003, ¶¶185-189, 64-67. Vaughn-290 discloses *recycled* particles that “are actually molecular sieve-containing catalyst particles that have been [sic] used in a functioning manufacture or reaction system, and have been reduced in size due to attrition.” WRG-1005, 9:55-65. Vaughn-290 discloses that the “catalyst fines are recovered from the manufacture or reaction system and are recycled back into the catalyst manufacturing scheme. The catalyst fines, therefore, are incorporated into the finished catalyst particles.” WRG-1005, 9:55-65, 16:26-35; WRG-1003, ¶¶185-189, 64-67. While Miura-Baker does not explicitly disclose an equilibrium or spent catalyst, a POSITA would have understood that “the recovery and use of the attrition particles in [a] catalyst is beneficial in minimizing waste, thereby reducing problems relating to both environmental and economic constraints.” WRG-1005, Abstract; WRG-1003, ¶¶185-189, 64-67.

A POSITA would have recognized the efficiencies and benefits of recycling catalyst material in combination with Miura’s eggshell and/or Baker’s non-uniform catalyst. A POSITA would have been prompted to pursue the efficiencies of Vaughn-290 as doing so is merely the application of known techniques (recycling

combustion promoter particles) to a known structure (the combustion promoter particles) to yield predictable results (minimizing waste). WRG-1003, ¶¶184-189, 64-67; *KSR*, 550 U.S. at 417. And a POSITA would have had a reasonable expectation of success in the Miura-Baker-Vaughn-290 combination given that each reference describes catalyst for use in a variety of catalytic reaction processes, including well-known CO to CO₂ combustion promotion process. WRG-1004, Abstract, [0014]; WRG-1008, 1:60-67, 4:66-5:12; WRG-1005, Abstract, 2:43-45; WRG-1003, ¶¶184-189, 64-67.

2. Analysis

(i) Claim 9

Miura-Baker-Vaughn-290 renders obvious claim 9. Miura-Baker renders obvious claim 1. *Supra* IV.D.3.(i). Vaughn-290 renders obvious an equilibrium or spent catalyst. *Supra* IV.B.3; WRG-1003, ¶190.

F. [GROUND 2B] – CLAIMS 10-11 ARE OBVIOUS OVER MIURA IN VIEW OF BAKER AND IN FURTHER VIEW OF PETERS OR, ALTERNATIVELY, VAUGHN 516¹³

1. Miura-Baker-Peters

A POSITA would have been motivated to combine the attrition index value of Peters to the combination of Miura-Baker. *Supra* IV.C.2; WRG-1003, ¶¶191-195, 68-71. Baker discloses a non-uniform structure similar to that of Miura,

¹³ Petitioner incorporates this discussion in IV.F.1, 2 into Ground 2B.

supra IV.D.1, wherein the catalyst comprises at least one catalytically active metal distributed therein. WRG-1008, 1:60-67, 4:66-5:12. Peters teaches the use of similar components, namely, the use of ceria as the preferred oxide component as the outer layer (most susceptible to attrition) of the eggshell structure disclosed by Miura-Baker. WRG-1004, [0068]; WRG-1008, 4:8-36, 4:66-5:12; WRG-1006, 1:49-60; WRG-1006, 1:49-60. And while Miura-Baker is silent as to the attrition index, Peters explicitly identifies the attrition index value. WRG-1006, 3:9-20.

A POSITA would have recognized that the attrition index value of Miura-Baker, using the same cerium oxide as the outer layer of the combustion particles, would have been similar or equivalent to the values disclosed in Peters. WRG-1003, ¶¶191-195. A POSITA would have been prompted to pursue the optimal attrition index of the combustion promoter particles as doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶191-195; WRG-1001, 6:53-63; *KSR*, 550 U.S. at 417. A POSITA would have expected success in the Miura-Baker-Peters combination given that each describe using cerium oxide as the preferred metal oxide component of the combustion promoter. WRG-1004, [0068]; WRG-1006, 1:49-60; WRG-1003, ¶¶191-195, 68-71.

2. Miura-Baker-Vaughn-516

A POSITA would have been motivated to combine the attrition index value of Vaughn-516 to the combination of Miura-Baker. *Supra* IV.C.4; WRG-1003, ¶¶196-200, 72-74. Baker discloses a non-uniform structure similar to that of Miura, *supra* IV.D.1, wherein the catalyst comprises at least one catalytically active metal distributed therein. WRG-1008, 1:60-67, 4:66-5:12. Vaughn-516 teaches the use of similar catalytic components of the catalyst particles, namely, the use of Group VIII metals, including platinum and palladium, in similar distribution to the eggshell structure disclosed by Miura-Baker. WRG-1007, [0108], [0164]; WRG-1004, [[0048], [0072], FIG2]; WRG-1008, 1:60-67, 4:39-47; WRG-1003, ¶¶196-200. Vaughn-516 specifically teaches that that the concentration of the Group VIII metal is low in the support material and this design choice is effective in reducing overall catalyst cost and “increasing catalyst strength such as crush strength and attrition resistance.” WRG-1007, [0106], [0108], [0164]. And while Miura-Baker is silent as to the attrition index, Vaughn-516 explicitly identifies the attrition index value. WRG-1007, [0131].

A POSITA would have recognized that the attrition index value of Miura-Baker, using the same catalytic components with similar distributions within the combustion particles, would have been similar or equivalent to the values disclosed in Vaughn-516. A POSITA would have been prompted to pursue the optimal

attrition index of the combustion promoter particles as doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶196-200, 72-74; WRG-1001, 6:53-63; *KSR*, 550 U.S. at 417. A POSITA would have expected success in the Miura-Baker-Vaughn-516 combination given that each describe using the same catalytic components with similar distributions within the combustion particles. WRG-1004, [0068]; WRG-1007, [0086]; WRG-1003, ¶¶196-200, 72-74.

3. Analysis

(i) Claim 10

Miura-Baker-Peters or Miura-Baker-Vaughn-516 renders obvious claim 10. Miura-Baker renders obvious claim 1. *Supra* IV.D.3.(i). Miura-Baker-Peters or Miura-Baker-Vaughn-516 renders obvious particle size between 40 and 105 microns with an attrition index between 5 and 25. *Supra* IV.C.5.(i); WRG-1003, ¶201.

(ii) Claim 11

Miura-Baker-Peters or Miura-Baker-Vaughn-516 renders obvious claim 11. Miura-Baker renders claim 1. *Supra* IV.D.3.(i). Miura-Baker-Peters or Miura-Baker-Vaughn-516 renders obvious particle size between 40 and 105 microns with an attrition index between 10 and 20. *Supra* IV.C.5.(ii); WRG-1003, ¶202.

**G. [GROUND 3] – CLAIMS 1-8 & 12-22 ARE OBVIOUS
OVER LIN IN VIEW OF BAKER¹⁴**

1. Lin

Lin is directed to “an eggshell catalyst and process for preparation of the same,” including “single- or multiple-metal eggshell of the finished catalyst.” WRG-1009, 1. Lin recognizes that “porous supports with active metals non-uniformly distributed have been widely studied and applied in petroleum refining and petroleum chemical industries currently.” *Id.* Lin teaches that the “eggshell” structure is known in the art as “eggshell catalysts have been widely employed in the industrially selective hydrogenation” because the “yield and selectivity of the desired products of the above reactions can be increased by using eggshell catalysts.” *Id.*, 1-2. Lin discloses an eggshell catalyst wherein the “[m]etal is distributed on the outer layer of the support (with eggshell shape), which is usually used in fast reactions and capable of improving the selectivity and yield of the desired products.” *Id.* See also WRG-1003, ¶¶204, 32, 39, 50, 60.

2. Lin-Baker

Lin teaches that “eggshell catalysts have been widely employed in the industrially selective hydrogenation” and, in particular, discloses “an eggshell-shaped catalyst for use in selective reduction or oxidation,” including, for example,

¹⁴ Petitioner incorporates this discussion in IV.G.1, 2 into Grounds 3, 3A, & 3B.

oxidation of CO. *Id.*, 1-2, 13; *supra* IV.G.1. Lin teaches an example wherein a catalyst was prepared using “spherical particles with diameter of 2mm.” *Id.*, 5. Lin does not expressly teach “microsphere” particle sizes of less than 1mm. Yet, a POSITA would have appreciated the use of 2mm particles in combination with the improved catalytic performance of the disclosed eggshell-shaped catalyst. *Id.*, 1-2, 13; WRG-1003, ¶¶205-208, 60-63. A POSITA would have considered the similar eggshell structure of the catalyst disclosed by Lin and the similar structure taught by Baker and have been motivated to use the disclosed particle sizes taught by Baker. WRG-1003, ¶¶205-208, 60-63.

Baker discloses a catalyst composition comprising support particles having at least one catalytically active metal distributed therein. WRG-1008, 1:60-67, 4:66-5:12. Baker discloses a non-uniformly distributed metal catalyst structure, which discloses a lower concentration of metal in the center of the particle. Baker teaches that the Group VIII noble metal “is distributed in the support particle . . . between an inner and an outer region of said support particle” such that the inner region has a lower concentration of the Group VIII noble metal. *Id.*, 1:60-67, 4:39-47.

As to the average particle size, Baker teaches that the support particles are “microspheroidal.” *Id.*, 3:34-46. Baker specifically teaches that the catalyst has the following particle size distribution:

0 to 20 microns	0-30 wt %
20 to 44 microns	0-60 wt %
44 to 88 microns	10-80 wt %
88 to 106 microns	0-80 wt %
>106 microns	0-40 wt %
>300 microns	0-5 wt %

id., 3:16-33, wherein the average particle size is approximately 73 microns. WRG-1003, ¶36. Baker teaches microsphere sized porous particles having an average diameter size of less than 1mm. *Id.* A POSITA would have understood that the particles with an average particle size less than 1mm may be used in conjunction with the combustion promoter of Lin. *Id.* Lin and Baker teach similar components of the combustion promoters, including silica, aluminum, and Group VIII metals, and the improved selectivity and yield of the eggshell-shaped catalyst. WRG-1009, 1-2. By incorporating the specific particle size range of Baker to Lin, a POSITA would have recognized that the properties of Lin's combustion promoter can be improved through the specific particle size teachings of Baker. WRG-1003, ¶¶205-208, 60-63.

A POSITA would have been prompted to pursue this implementation of Baker's specific particle size into Lin's catalyst as doing so is merely the application of known techniques (using small particles) to a known structure (combustion promoter material) to yield predictable results (improved performance). WRG-1003, ¶¶205-208, 60-63; *KSR*, 550 U.S. at 417. A POSITA would have expected success in the Lin-Baker combination given that Lin and

Baker describe using similarly sized particles for improved catalytic performance.

WRG-1003, ¶¶205-208, 60-63. A POSITA would have recognized that the difference in size from 1mm to 2mm is not significant, because it was well-known in the art to use particle sizes ranging by order of magnitude, as evidenced by the complete range of the microsphere sized particles as defined by the '864 Patent (*i.e.*, 1mm to zero). *Id.*

3. Analysis

(i) Claim 1

[1pre]: To the extent the preamble is deemed limiting, Lin-Baker renders obvious [1pre]. Lin teaches that “eggshell catalysts have been widely employed in the industrially selective hydrogenation” and, in particular, discloses “an eggshell-shaped catalyst for use in selective reduction or oxidation,” including, for example, oxidation of CO. WRG-1009, 1-2, 13. Lin teaches an example wherein a catalyst was prepared using “spherical particles with diameter of 2mm.” *Id.*, 5. Lin does not explicitly discloses particles with diameters below 1mm.

Baker discloses microspheroidal particles having an average particle size of approximately 73 microns. WRG-1008, 1:60-67, 3:16-46, 4:66-5:12; WRG-1003, ¶36; *supra* IV.D.3.(i).

A POSITA would have been motivated to use the particles less than 1mm, as disclosed by Baker, in an eggshell-shaped catalyst, as described by Lin, in light of

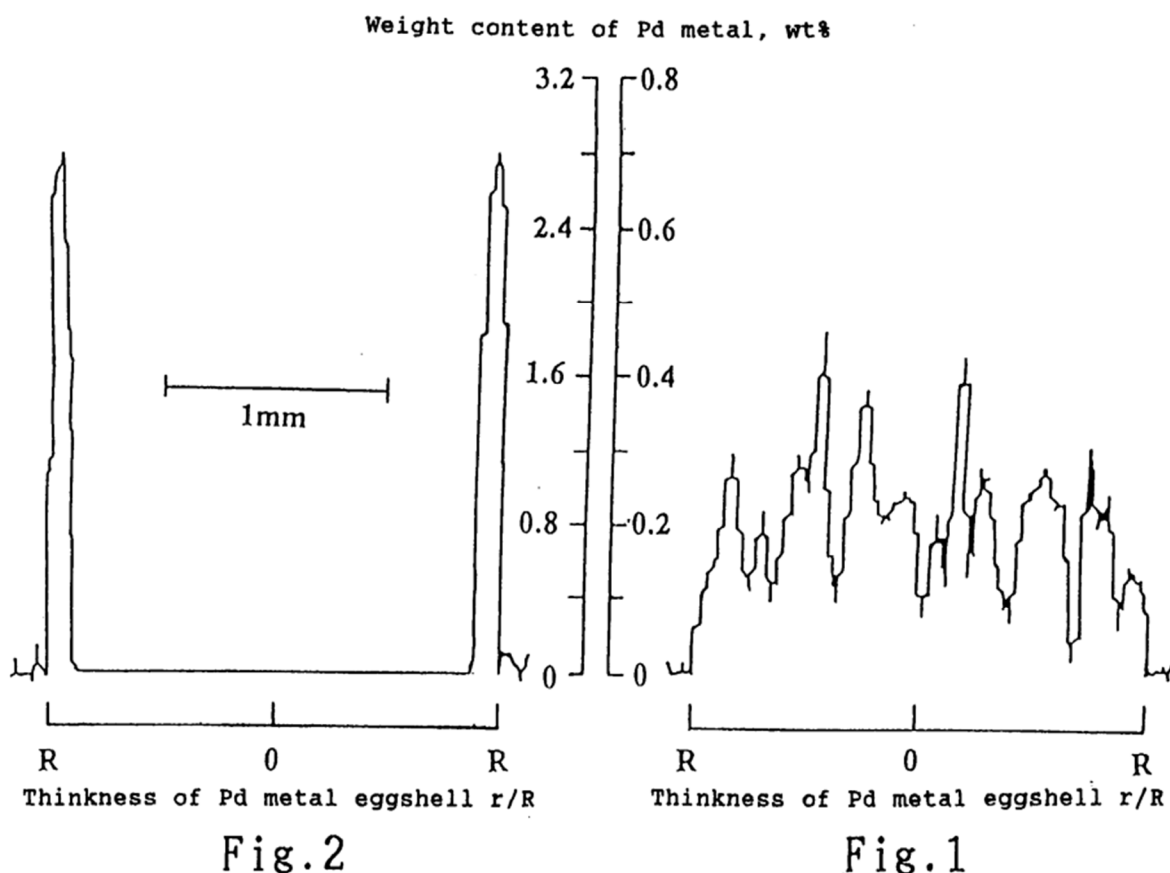
the small (2mm) particle size disclosed by Lin. WRG-1003, ¶¶209-211. A POSITA would have recognized that the difference in size from 1mm to 2mm is not significant, in particular, because, as Applicant *admitted*, it was well-known in the art to use particle sizes ranging by order of magnitude, as evidenced by the complete range of the microsphere sized particles as defined by the '864 Patent (*i.e.*, 1mm to zero). *Id.*

[1a]: Lin discloses [1a]. Lin teaches an “eggshell metal catalyst” wherein the active metal is attached to a support comprising “*Al₂O₃, SiO₂ . . . or the mixtures thereof.*” WRG-1009, 3. Lin discloses “various non-uniformly distributed Pt on spherical *alumina support.*” *Id.*, 2. In addition, Lin discloses an example wherein a “catalyst with linear decrease of Pd metal distribution from the outer layer toward the spherical core” comprises spherical γ -*Al₂O₃.* *Id.*, 10. Lin teaches that the active metal “is attached to a support by wet impregnation or *spray method*, in which the support comprises Al₂O₃, *SiO₂*, zeolite, TiO₂, ZrO₂, MgO, active carbon, polymer or the mixtures thereof.” *Id.*, 3. WRG-1003, ¶¶212-213.

Baker discloses [1a]. *Supra* IV.D.3.(i).

[1b]: Lin discloses [1b]. Lin discloses an eggshell catalyst wherein the “[m]etal is distributed on the outer layer of the support (with eggshell shape).” *Id.*, 1-2. Lin teaches that the metal catalysts with eggshell active metal profile comprises platinum and/or palladium. *Id.*, Abstract, 3. Lin provides an example

wherein the preparation of the catalyst “*with linear decrease of Pd metal distribution from outer layer toward spherical core.*” *Id.*, 10. Lin provides a comparison of a uniform particle in FIG1 (right) and an eggshell particle in FIG2 (left); Lin demonstrates the decrease of Pd metal distribution in FIG2 showing the Pd distribution in an eggshell catalyst from electron probe microanalyser:



Id., 3-4, FIG1, FIG2. A POSITA would have understood that the example disclosed in Lin demonstrates both a higher content (mass) of active metal in the outer layer of the support and a higher concentration (mass/volume) and/or weight

percentage (mass/mass) of active metal is present in the outer layer compared to the core. *Id.*; WRG-1003, ¶214.

(ii) Claim 2

Lin discloses claim 2. Lin discloses silica. WRG-1009, 3; *supra* IV.G.3.(i). Baker discloses claim 2. *Supra* IV.D.3.(i); WRG-1003, ¶¶215-216.

(iii) Claim 3

Lin discloses claim 3. Lin discloses alumina. WRG-1009, 2, 3, 10; *supra* IV.G.3.(i). Baker discloses claim 3. *Supra* IV.D.3.(i); WRG-1003, ¶¶217-218.

(iv) Claim 4

Lin discloses claim 4. Lin discloses silica and alumina. WRG-1009, 2, 3, 10; *supra* IV.G.3.(i). Baker discloses claim 4. *Supra* IV.D.3.(i); WRG-1003, ¶¶219-220.

(v) Claim 5

Lin discloses claim 5 by disclosing silica, alumina, and mixtures thereof. WRG-1009, 2, 3, 10; *supra* IV.G.3.(i). Baker discloses claim 5. *Supra* IV.D.3.(i): WRG-1003, ¶¶221-222.

(vi) Claim 6

Baker discloses claim 6. *Supra* IV.D.3.(i); WG-1003, ¶223.

(vii) Claim 7

Lin discloses claim 7 by disclosing γ -alumina. WRG-1009, 2, 3, 10; *supra* IV.G.3.(i); WRG-1003, ¶224.

(viii) Claim 8

Lin discloses claim 8 by disclosing spray dried silica particles. WRG-1009, 3; *supra* IV.G.3.(i). Baker discloses claim 8. *Supra* IV.D.3.(i), (viii); WRG-1003, ¶225-226.

(ix) Claim 12

Lin discloses claim 12 by disclosing platinum and palladium. WRG-1009, Abstract, 1-2, 3; *supra* IV.G.3.(i). Baker discloses claim 12. *Supra* IV.D.3.(ix); WRG-1003, ¶¶227-228.

(x) Claim 13

Lin discloses claim 13 by disclosing platinum and palladium. WRG-1009, Abstract, 1-3; *supra* IV.G.3.(i). Baker discloses claim 13. *Supra* IV.D.3.(ix); WRG-1003, ¶¶229-230.

(xi) Claim 14

Lin discloses claim 14 by disclosing platinum. WRG-1009, Abstract, 1-3; *supra* IV.G.3.(i). Baker discloses claim 14. *Supra* IV.D.3.(ix); WRG-1003, ¶¶231-232.

(xii) Claim 15

Lin discloses claim 15 by disclosing palladium. WRG-1009, Abstract, 1-3; *supra* IV.G.3.(i). Baker discloses claim 15. *Supra* IV.D.3.(ix); WRG-1003, ¶¶233-234.

(xiii) Claim 16¹⁵

Lin discloses claim 16. Lin is directed to “an eggshell catalyst” wherein the metal catalysts with eggshell active metal profile comprises copper. WRG-1009, Abstract, 3; *supra* IV.G.3.(i). Lin teaches that *copper nitrate (Cu(NO₃)₂)* is “used by means of various impregnation technologies to produce *non-uniformly distributed* Cr and *Cu metal in different state* on spherical Al₂O₃ support.” *Id.*, 1-2. A POSITA would have understood the similar properties of copper oxide and copper nitrate, as taught by Lin, in application to catalytic reactions. WRG-1003, ¶235-236. A POSITA would have easily substituted copper oxide for copper nitrate. *Id.* A POSITA would have understood that copper is easily oxidized when exposed to air and the “Cu metal in different states on spherical Al₂O₃ support” may include copper metal naturally oxidized. *Id.*; WRG-1009, 1-2.

¹⁵ Claim 16 suggests the claimed invention is enabled when comprising copper oxide despite the various possible understandings of POSITAs as to the exact composition of copper oxide. Petitioner reserves all rights to challenge the claim under 35 U.S.C. §112 outside of the PTAB context but for purposes of this petition, Petitioner is treating the claim as if copper oxide is inclusive of various oxidized forms of copper metal.

Baker discloses claim 16. *Supra* IV.D.3.(xiii).

(xiv) Claim 17

Lin discloses claim 17. Lin discloses “an eggshell catalyst” wherein the metal catalysts with eggshell active metal profile comprises non-uniformly distributed Cu metal in different state, such as copper nitrate. *Id.*, 1-2; *supra* IV.G.3.(i), (xiii); WRG-1003, ¶237. A POSITA would have easily substituted copper oxide for copper nitrate. *Id.*

(xv) Claim 18¹⁶

[18pre]: As described above, Lin discloses [18pre]. *Supra* IV.G.3.(i); WRG-1003, ¶238.

[18a]: Lin-Baker renders obvious [18a]. *Supra* IV.G.3.(i), IV.D.3.(i); WRG-1003, ¶239-241.

[18b]: Lin discloses [18b]. Lin discloses a process for preparing a catalyst with linear decrease of Pd metal distribution from the outer layer toward the spherical core wherein the first step is dissolving an *aqueous salt solution*—*Ni(NO₂)₂·6H₂O*—with a Group VIII noble metal, nickel, in deionized water and placing “spherical γ -Al₂O₃” in the solution. WRG-1009, 10.

¹⁶ Lin-Baker renders obvious claim 18 because the combination renders obvious claim 1. *See* MPEP §2113.

Baker discloses [18b]. *Supra* IV.D.3.(xv). WRG-1003, ¶242-243

[18c]: Lin discloses [18c]. Lin discloses a process for preparing a catalyst with linear decrease of Pd metal distribution from the outer layer toward the spherical core wherein the first step is dissolving an aqueous salt solution. WRG-1009, 10. Lin teaches analyzing the resulting catalyst sample to determine the distribution of palladium such that *“[o]bviously, the Pd metal distribution exhibits a linear decrease from outer layer toward spherical core.”* *Id.*; *id.*, FIG17.

Baker discloses [18c]. *Supra* IV.D.3.(xv). WRG-1003, ¶244

(xvi) Claim 19

Lin discloses claim 19. Lin discloses a process for preparing a catalyst wherein the second step as placing the resulting catalyst sample “in a solution of over-saturated Pd(CH₃COO)₂/toluene and treated by wet impregnation for 0.5 hour” and then “filtering and *drying at 110°C for 1 hour.*” WRG-1009, 10.

Baker discloses claim 19. *Supra* IV.D.3.(xvi). WRG-1003, ¶¶245-246.

(xvii) Claim 20

Lin-Baker renders obvious claim 20. First, Lin-Baker teaches the claimed particles. Lin discloses γ -alumina. WRG-1009, 10; *supra* IV.G.3.(i). Lin teaches using “spherical particles with diameter of 2mm.” *Id.*, 5. Baker teaches an average (D50) size of between 60 and 90 microns. *Supra* IV.D.3.(i). A POSITA would have understood that the γ -alumina particles with an average particle size

between 60 and 90 microns may be used. WRG-1003, ¶¶247-249. Lin teaches the use of γ -alumina particles and using small (2mm) particles in an eggshell catalyst. WRG-1009, 10. A POSITA would have been motivated to combine the small γ -alumina particles, as described by Lin, with the average particles size disclosed by Baker. WRG-1003, 247-249. A POSITA would have recognized that the difference in size from 1mm to 2mm is not significant because, as Applicant admitted, it was well-known in the art to use particle sizes ranging by order of magnitude, as evidenced by the complete range of the microsphere sized particles as defined by the '864 Patent (*i.e.*, 1mm to zero). *Id.*

Lin discloses the claimed surface area. Lin discloses “spherical particles with diameter of 2mm, surface area of 82.4 m²/g”. WRG-1009, 5, 10. A POSITA would have recognized that Lin teaches an overlap of the claimed surface area. WRG-1003, ¶¶247-249.

Baker discloses the claimed surface area and pore volume. *Id.*; *supra* IV.D.3.(xvii).

(xviii) Claim 21

Lin discloses claim 21. Lin teaches discloses a process for preparing a catalyst wherein the first step is dissolving an aqueous salt solution with a Group VIII noble metal *in deionized water*. WRG-1009, 10.

Baker discloses claim 21. *Supra* IV.D.3.(xviii). WRG-1003, ¶¶250-251.

(xix) Claim 22

Baker discloses claim 22. *Supra* IV.D.3.(xix). WRG-1003, ¶252.

**H. [GROUND 3A] – CLAIM 9 IS OBVIOUS OVER LIN IN
VIEW OF BAKER AND IN FURTHER VIEW OF
VAUGHN 290¹⁷**

1. Lin-Baker-Vaughn-290

Lin discloses “an eggshell catalyst and process for preparation of the same,” including “single- or multiple-metal eggshell of the finished catalyst” wherein the “[m]etal is distributed on the outer layer of the support (with eggshell shape), which is usually used in fast reactions and capable of improving the selectivity and yield of the desired products.” WRG-1009, 1-2; *supra* IV.G.1. Baker discloses a non-uniform structure similar to that of Lin, *supra* IV.D.1, wherein the catalyst comprises at least one catalytically active metal distributed therein. WRG-1008, 1:60-67, 4:66-5:12. Vaughn-290 discloses a catalyst for use in a variety of catalytic reaction processes, and a POSITA would have recognized the variety of catalytic reaction processes as including a CO to CO₂ combustion promoter. WRG-1005, Abstract, 2:43-45. Vaughn-290 discloses *recycled* particles that “are actually molecular sieve-containing catalyst particles that have been [sic] used in a functioning manufacture or reaction system, and have been reduced in size due to attrition.” *Id.*, 9:55-65. Vaughn-290 discloses that the “catalyst fines are

¹⁷ Petitioner incorporates this discussion in IV.H.1 into Ground 3A.

recovered from the manufacture or reaction system and are recycled back into the catalyst manufacturing scheme. The catalyst fines, therefore, are incorporated into the finished catalyst particles.” WRG-1005, 9:55-65, 16:26-35. While Lin-Baker does not disclose an equilibrium or spent catalyst, a POSITA would have understood that “the recovery and use of the attrition particles in [a] catalyst is beneficial in minimizing waste, thereby reducing problems relating to both environmental and economic constraints.” WRG-1005, Abstract. WRG-1003, ¶¶253-256, 64-67.

A POSITA would have recognized the efficiencies and benefits of recycling catalyst material in combination with Lin’s eggshell and/or Baker’s non-uniform catalyst. A POSITA would have been prompted to pursue the efficiencies of Vaughn-290 as doing so is merely the application of known techniques (recycling combustion promoter particles) to a known structure (the combustion promoter particles) to yield predictable results (minimizing waste). WRG-1003, ¶¶253-256, 64-67; *KSR*, 550 U.S. at 417. A POSITA would have expected success in the Lin-Baker-Vaughn-290 combination given that each reference describes catalyst for use in a variety of catalytic reaction processes. WRG-1009, 1-2; WRG-1008, 1:60-67, 4:66-5:12; WRG-1005, Abstract, 2:43-45; WRG-1003, ¶253-256, 64-67.

2. Analysis

(i) Claim 9

Lin-Baker-Vaughn-290 renders obvious claim 9. Lin-Baker renders obvious claim 1. *Supra* IV.G.3.(i). Vaughn-290 renders obvious an equilibrium or spent catalyst. *Supra* IV.B.3. WRG-1003, ¶257

I. [GROUND 3B] – CLAIMS 10-11 ARE OBVIOUS OVER LIN IN VIEW OF BAKER AND IN FURTHER VIEW OF PETERS OR, ALTERNATIVELY, VAUGHN 516¹⁸

1. Lin-Baker-Peters

A POSITA would have been motivated to combine Lin and Baker, and further combine Peters. *Supra* IV.G.2. Neither Lin nor Baker expressly discloses an attrition index of the metal oxide particles, though a POSITA would have understood that catalyst material should be durable and attrition-resistant and a low attrition index is desirable, while reducing NO_x emissions. WRG-1003, ¶¶258-262, 68-71. Peters discloses a reduced NO_x combustion promoter for use in FCC processes. WRG-1006, 1:49-60. Lin, Baker, and Peters teach the use of similar components, namely, the use of ceria or copper as the preferred oxide component as the outer layer (most susceptible to attrition) of the eggshell structure disclosed by Lin. WRG-1009, Abstract, 2, 3; WRG-1008, 4:8-36, 4:66-5:12; WRG-1006, 1:49-60. A POSITA would have understood the similar properties of cerium oxide

¹⁸ Petitioner incorporates this discussion in IV.I.1, 2 into Ground 3B.

and copper oxide in application to catalytic reactions. WRG-1003, ¶¶258-262, 68-71. While Lin-Baker is silent as to the attrition index, Peters explicitly identifies the attrition index value. WRG-1006, 3:9-20.

A POSITA would have recognized that the attrition index value of Lin-Baker, using cerium oxide or copper oxide as the outer layer of the combustion particles, would have been similar or equivalent to the values disclosed in Peters. WRG-1003, ¶¶258-262, 68-71. A POSITA would have been prompted to pursue the optimal attrition index of the combustion promoter particles as doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶258-262, 68-71; WRG-1001, 6:53-63; *KSR*, 550 U.S. at 417. A POSITA would have expected success in the Lin-Baker-Peters combination given that each describe using cerium oxide or copper oxide as the metal oxide component of the combustion promoter. WRG-1009, Abstract, 2, 3; WRG-1006, 1:49-60; WRG-1003, ¶¶258-262, 68-71.

2. Lin-Baker-Vaughn-516

A POSITA would have been motivated to combine Lin and Baker, and further combine Vaughn-516. *Supra* IV.G.2. Similar to Lin and Baker, WRG-1009, Abstract, 2, 3; WRG-1008, 4:8-36, 4:66-5:12, Vaughn-516 teaches that the benefit of the disclosed processes is to obtain a formulated catalyst mixture with

desirable catalytic activity characteristics for use in a reaction system. WRG-1007, Abstract. Lin, Baker, and Vaughn-516 teach the use of similar components, namely, Group VIII metals, including platinum and palladium, as reactive components of the catalytic particle in a similar distribution to the eggshell structure disclosed by Lin. WRG-1009, Abstract, 2, 3; WRG-1008, 4:8-36, 4:66-5:12; WRG-1007, [0108], [0164]. Vaughn-516 specifically teaches that the concentration of the Group VIII metal is low in the support material and this design choice is effective in reducing overall catalyst cost and “increasing catalyst strength such as crush strength and attrition resistance.” WRG-1007, [0106], [0108], [0164]. While Lin-Baker is silent as to the attrition index, Vaughn-516 explicitly identifies the attrition index value. WRG-1007, [0131].

A POSITA would have recognized that the attrition index value of Lin-Baker, using the same catalytic components with similar distributions within the combustion particles, would have been similar or equivalent to the values disclosed in Vaughn-516. WRG-1003, ¶¶263-267, 72-74. A POSITA would have been prompted to pursue the optimal attrition index of the combustion promoter particles as doing so is merely the application of known techniques (standard attrition measurement) to a known structure (the combustion promoter particles) to yield predictable results (improved attrition properties). WRG-1003, ¶¶263-267, 72-74; WRG-1001, 6:53-63; KSR, 550 U.S. at 417. A POSITA would have

expected success in the Lin-Baker-Vaughn-516 combination given that each describe using the same catalytic components with similar distributions within the combustion particles. WRG-1009, Abstract, 2, 3; WRG-1008, 4:8-36, 4:66-5:12; WRG-1007, [0086]; WRG-1003, ¶¶263-267, 72-74.

3. Analysis

(i) Claim 10

Lin-Baker-Peters or Lin-Baker-Vaughn-516 renders obvious claim 10. Lin-Baker renders obvious claim 1. *Supra* IV.G.3.(i). Peters or Vaughn-516 renders obvious particle size between 40 and 105 microns with an attrition index between 5 and 25. *Supra* IV.C.5.(i); WRG-1003, ¶268.

(ii) Claim 11

Lin-Baker-Peters or Lin-Baker-Vaughn-516 renders obvious claim 11. Lin-Baker renders obvious claim 1. *Supra* IV.G.3.(i). Peters or Vaughn-516 renders obvious particle size between 40 and 105 microns with an attrition index between 10 and 20. *Supra* IV.C.5.(ii); WRG-1003, ¶269.

**J. [GROUND 4] – CLAIMS 1-4, 6, 12-15, 18-19, 21-22 ARE
OBVIOUS OVER ESPINOZA IN VIEW OF AAPA¹⁹**

1. Espinoza

Espinoza is directed to a catalyst comprising an inner core and outer layer wherein the outer layer contains catalytically active metal, such as a Group VIII metal, which is *not* deposited in the core of the particle. WRG-1011, 4:26-47. Espinoza teaches the cost efficiency of loading the catalytically active metal on the outer layer of the particle and identifies that “uniform dispersion inherently exiles a substantial amount of catalytic metal to the deep internal surfaces or ‘core’ of a support.” *Id.*, 2:37-44. Espinoza is instructive that a smaller particle size may be more appropriate in the application of fluidized catalysts whereas a larger particle size is appropriate in a fixed bed catalyst application. *Id.*, 7:51-67. Specifically, Espinoza teaches that particle size ranging from 0.5 mm to 0.25 mm are most useful in fluidized bed catalyst reactions. *Id.*, 7:51-67. WRG-1003, ¶¶271-278, 33, 38.

2. Analysis

(i) Claim 1

[1pre]: To the extent the preamble is limiting, Espinoza-AAPA renders obvious [1pre]. Espinoza discloses catalyst compositions capable of converting

¹⁹ Petitioner incorporates this discussion in IV.J.1 into Ground 4.

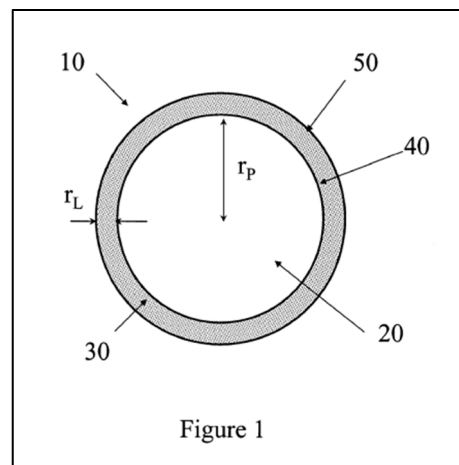
methane-containing gas to carbon monoxide and hydrogen (*i.e.*, “synthesis gas” or “syngas”). WRG-1011, Abstract, 1:34-53. A POSITA would recognize the similarity of chemistry in the catalytic reaction described by Espinoza to CO to CO₂ combustion reaction and that the CO to CO₂ combustion is an example of the type of reaction that would have benefited from an eggshell structure, like that disclosed by Espinoza. WRG-1003, ¶¶279-280. Espinoza discloses a range of particle sizes from 0.5 mm to 0.25 mm. WRG-1011, 7:51-67. Espinoza renders obvious a CO to CO₂ combustion catalyst including microsphere sized particles having a diameter size of less than 1mm. WRG-1003, ¶¶279-280.

Applicant admitted that microsphere sized particles were well-known in the art. *Supra* IV.A.3.(i). A POSITA would have been motivated to use particles ranging in size from 1 mm in diameter and smaller with the combustion catalyst disclosed in Espinoza in light of the disclosure in Espinoza of particle sizes 0.5 mm to 0.25 mm. WRG-1003, ¶¶279-280.

[1a]: Espinoza discloses [1a]. Espinoza discloses that the catalytic composition comprises “support material such as alumina, silica” WRG-1011, 2:28-36. Espinoza teaches that this support may comprise mixtures of silica and alumina. *Id.*, 10:22-24.

Applicant further admitted that CO to CO₂ combustion promoters commonly comprise alumina and/or other substrate microspheres. *Supra* IV.A.3.(i): WRG-1003, ¶¶281-282.

[1b]: Espinoza discloses [1b]. Espinoza discloses “preferred embodiments of the present invention comprise catalyst systems comprising a core and an outer region disposed on said core, wherein a substantial amount of the catalytic metal is located in the outer region of the catalyst support matrix.” WRG-1011, Abstract. Espinoza teaches that “[t]he more preferred catalytic metals are Group VIII or noble metals, such as rhodium, platinum, or palladium” present on the outer region of the catalyst. *Id.*, 2:29-3:45. Espinoza teaches that not only is the content (mass) of the noble metal higher in the outer region compared to the core but also the concentration (mass/volume) and/or weight percentage (mass/mass) of noble metal is higher in the outer region compared to the core. WRG-1011, 2:50-53, 4:5-47, 5:52-7:67. Espinoza teaches a greater percentage of noble metal in the outer region compared to the core. *Id.* Espinoza depicts this resulting eggshell structure in FIG1 wherein the core 20 contains “substantially zero catalytic material” and the outer region 30 comprises “more than 50% of the catalytically active material.” *Id.*, 4:5-47, FIG1; *id.*, 5:52-7:67, FIG2. In this manner, as shown and described with



respect to FIG1, Espinoza teaches that the noble metals are distributed in the particle as an eggshell such that a higher concentration of the noble metals is present in the outer region as compared to the concentration of the noble metals in the center of the particle. WRG-1003, ¶283.

(i) Claim 2

Espinoza discloses claim 2 by disclosing silica. WRG-1011, 2:28-36, 10:22-24; *supra* IV.J.2.(i); WRG-1003, ¶284.

(ii) Claim 3

Espinoza discloses claim 3 by disclosing alumina. WRG-1011, 2:28-36, 10:22-24; *id.*, 1:12-22; *supra* IV.J.2.(i); WRG-1003, ¶285.

(iii) Claim 4

Espinoza discloses claim 4 by disclosing silica, alumina, and mixtures thereof. WRG-1011, 2:28-36, 10:22-24; *supra* IV.J.2.(i); WRG-1003, ¶286.

(iv) Claim 6

Espinoza-AAPA renders obvious claim 6. Espinoza discloses a range of particle sizes from 0.5 mm to 0.25 mm. WRG-1011, 7:51-67; *supra* IV.J.2.(i); WRG-1003, ¶287. To the extent, Espinoza does not explicitly disclose an average size of between 60 and 90 microns, as discussed above in Section IV.A.3.(i), Applicant admitted that “*microspheres of average particle size 60 to 90 microns*” were known in the art. WRG-1001, 1:62-2:3. A POSITA would have known that particles having an average diameter size of less than 1mm, and an average size of

between 60 and 90 microns, was known for use in CO to CO₂ combustion promoters like those disclosed in Espinoza. WRG-1003, ¶287.

(i) Claim 12

Espinoza discloses claim 12 by disclosing rhodium, platinum, or palladium. WRG-1011, 2:29-36-3:45; *supra* IV.J.2.(i); WRG-1003, ¶288.

(ii) Claim 13

Espinoza discloses claim 13 by disclosing platinum and palladium. WRG-1011, 2:29-36-3:45; *supra* IV.J.2.(i); WRG-1003, ¶289.

(iii) Claim 14

Espinoza discloses claim 14 by disclosing platinum. WRG-1011, 2:29-36-3:45; *supra* IV.J.2.(i); WRG-1003, ¶290.

(iv) Claim 15

Espinoza discloses claim 15 by disclosing palladium. WRG-1011, 2:29-36-3:45; *supra* IV.J.2.(i); WRG-1003, ¶291.

(i) Claim 18²⁰

[18pre]: To the extent the preamble is limiting, Espinoza-AAPA renders obvious [18pre]. *Supra* IV.J.2.(i); WRG-1003, ¶¶292-293.

²⁰ Espinoza-AAPA renders obvious claim 18 because the combination renders obvious claim 1. *See* MPEP §2113.

[18a]: Espinoza-AAPA discloses [18a]. Espinoza discloses eggshell catalyst particles having an average diameter size of less than 1mm. WRG-1011, Abstract, 4:5-47, 7:51-67; *supra* IV.J.2.(i); WRG-1003, ¶¶294-295. Espinoza discloses a method for preparing the catalytic composition to obtain the preferred eggshell structure by “applying a solution of a **pore-blocking agent** such as silicic acid or sodium carbonate, to the support particle.” *Id.*, 4:26-47; 8:39-59.

A POSITA would have combined Espinoza with AAPA to apply the teachings of Espinoza to the full range of microsphere sized pores. *Supra* IV.J.2.(i); WRG-1003, ¶¶294-295.

[18b]: Espinoza discloses [18b]. Espinoza teaches a method of preparing the catalytic composition wherein “the particles are then provided a catalytically active material for catalyzing reactions, wherein the catalytically active material preferably comprises a **Group VIII metal**.” WRG-1011, 4:26-47. Espinoza provides an example of loading the Group VIII metal via an aqueous salt solution of rhodium. *Id.*, 10:48-56. WRG-1003, ¶296.

[18c]: Espinoza discloses [18c]. Espinoza teaches that the Group VIII metal is “dispersed in the outer layer, wherein the catalytically active material does not substantially penetrate and deposit into the core because of the blocked pores.” WRG-1011, 4:26-47. Espinoza teaches that the disclosed method of preparation

“preferentially deposit[s] catalytic material near the outer surface of the porous catalyst support.” *Id.*, 8:39-59. WRG-1003, ¶297.

(ii) Claim 19

Espinoza discloses claim 19 by disclosing the preparation of the eggshell catalyst composition wherein the method includes “(i) . . . ***calcining*** the catalyst particle such that a substantial portion of micropores of the particle are filled or blocked; (ii) immersion in water followed by ***drying*** . . . then ***calcining*** in air.” WRG-1011, 8:39-59; WRG-1003, ¶298.

(iii) Claim 21

Espinoza discloses claim 21 by disclosing the preparation of the eggshell catalyst composition wherein the method includes applying a solution sodium carbonate to the support particle and “[t]he catalyst compositions were then ***washed with distilled water*** to remove sodium. WRG-1011, 4:26-47; 8:39-59, 10:40-67; WRG-1003, ¶299.

(iv) Claim 22

Espinoza discloses claim 22. Espinoza teaches a method of preparing the catalytic composition wherein “the particles are then provided a catalytically active material for catalyzing reactions, wherein the catalytically active material preferably comprises a Group VIII metal.” WRG-1011, 4:26-47. Espinoza provides an example of loading the Group VIII metal via an aqueous salt solution of rhodium “using an appropriate quantity to achieve incipient wetness with the

desired loading” of rhodium. *Id.*, 10:48-56. A POSITA would have understood that to incorporate a desirable level of metal compound into the support particle on the outer region, as taught by Espinoza, the salt solution must be up to or less than the total volume of the pores of the starting microsphere sized particles. WRG-1003, ¶300. A POSITA would have understood that deviating from the teaching of Espinoza and using excess solution more than the total volume of the pores would prevent the deposition of the metal compound on the outer region of the support particle. WRG-1003, ¶300.

V. THE BOARD SHOULD CONSIDER THE PETITION ON THE MERITS AND NOT EXERCISE ITS DISCRETION TO DENY INSTITUTION

A. 35 U.S.C. §325(d) – *Advanced Bionics*

Advanced Bionics and the *Becton* factors strongly favor institution. *Advanced Bionics LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020)(“*Advanced Bionics*”)(precedential); *Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15 2017)(“*Becton*”)(precedential).

None of the references used in the grounds in this Petition were cited during the ’864 Patent’s prosecution, WRG-1002, and Petitioner’s art and arguments cannot be said to be the same as, or substantially similar to, art and arguments previously presented to the Office. *Id.* Neither condition of the first prong of the

Advanced Bionics framework is met, and there is no need to reach the second prong to resolve against discretionary denial under Section 325(d). *Oticon Medical AB et al. v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (PTAB Oct. 16, 2019)(precedential).

The Challenged Claims were allowed based on the Examiner's mistaken view that the prior art failed to disclose "the concentration . . . of the claimed noble metal is change [sic] from the outer region of the claimed promoter to its inner region." WRG-1002, 212. As demonstrated here with reference to Dr. Harold's testimony, the Examiner's failure to consider obviousness of the Challenged Claims over the uncited references constitutes material error. Petitioner respectfully submits that discretionary denial is unwarranted, and that the Board should instead institute IPR based on the instant Petition's grounds.

B. The *General Plastic* Factors Weigh Against Exercising Discretion To Deny Institution

In *General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357—01361, Paper 19 at 9-10 (Sept. 6, 2017) (PTAB Precedential), the Board identified seven factors that inform application of discretionary institution denials under 35 U.S.C. §314(a). Evaluation of these factors weighs against using the Board's discretion to deny this petition without consideration on the merits.

1. Factor 1: First petition against the Challenged Claims

The first factor weighs heavily in favor of considering this Petition on the merits because no petitioner, including Grace, has previously filed any petition challenging the '864 Patent. This factor is substantively dispositive as to whether the petition should be discretionarily denied. *Acronis, Inc., v. Realtime Data LLC*, IPR2018-00706, Paper 11, 15-16 (Oct. 1, 2018). Deciding this petition on the merits would not be unfair to Patent Owner, but exercising discretion to deny consideration of the only petition Petitioner advanced would be unfair to Petitioner.

2. Factors 2, 4-5: Grace filed this Petition promptly after searching revealed new prior art

Factors 2, 4, and 5 do not weigh against consideration of this Petition. Petitioner learned of Miura, Baker, Lin, Espinoza, Vaughn-290, Peters, and Vaughn-516 through prior art searching conducted in February and March of 2023. Upon discovering these references, Petitioner worked diligently to prepare and file the present Petition.

3. Factor 3: This Petition does not implicate road-mapping concerns

The third factor does not weigh against consideration of this Petition because Petitioner did not delay filing this petition for the purpose of using an earlier proceeding as a roadmap. Because the present Petition is the first challenge to the Challenged Claims, Petitioner derived no benefit from any earlier petitions.

4. Factors 6-7: Institution would efficiently promote patent quality

The sixth and seventh factors weigh in favor of considering this petition when considering the limited resources of the Board, balanced against the usefulness of invalidating patents in view of the relevant prior art cited here. The present Petition is the only IPR before the Board, providing for efficient resolution of the unpatentability of the '864 Patent within one year after institution. This is especially the case where there is no evidence of prejudicial “road-mapping” or other gamesmanship by Petitioner that would warrant the punitive measure of denial without consideration on the merits, where there is no other IPR pending against the '864 Patent.

Because Petitioner filed a single petition against the '864 Patent and has a meaningful due process interest to be heard in this forum on the merits in light of the termination of the earlier IPR proceedings against the '864 Patent, the *General Plastic* factors weigh in favor of instituting IPR.

While concurrent district court litigation involving the '864 Patent is ongoing, it remains at an early phase, with the complaint having only been filed in October 2022. Petitioner has worked diligently to identify and apply prior art discussed herein to file the Petition well before its statutory deadline. Dr. Harold is the expert for Petitioner in the present IPR proceeding, and provides significant evidence not of record in the district court.

C. The *Fintiv* Factors Weigh Against Exercising Discretion To Deny Institution

The PTAB considers a set of non-exclusive factors in determining whether to institute an IPR proceeding where there is parallel district court litigation. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (designated precedential May 5, 2020) (“*Fintiv*”). Petitioner’s efforts to promote fairness and efficiency, paired with the strong merits of the presented grounds, provide compelling reasons to institute. *id.*; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019 Paper 12 at 20-21 (PTAB Dec. 1, 2020)(precedential); *Snap, Inc. v. SRK Technology LLC*, IPR2020-00820 Paper 15 at 19 (PTAB Oct. 21, 2020)(precedential).

Factor 1 (Stay): This factor is neutral because no party has approached the Maryland Court with a motion to stay regarding the ’864 Patent. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (PTAB May 13, 2020)(“*Fintiv IP*”)(informative); *Sand Revolution II, LLC v. Cont’l Intermodal Group–Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB Jun. 16, 2020)(“*Sand Revolution*”)(informative).

Factor 2 (Trial Date): The co-pending litigation is in its infancy and the Court has not scheduled a trial date yet. Even if a trial date were set, the Board should not take any estimated trial date from the Maryland Court at face value because an estimate is intrinsically infirm. *Progenity, Inc. v. Natera, Inc.*,

IPR2021-00279, Paper 12 at 29 (PTAB Jun. 11, 2021); *Intel Corp., v. FG SRC LLC*, IPR2020-01449, Paper 13 at 15 (PTAB Mar. 3, 2021); *MediaTek Inc. et al v. Nippon Telegraph and Telephone Corp.*, IPR2020-01404, Paper 14 at 10-11 (PTAB Feb. 16, 2021). Factor 2 weighs against the Board exercising its discretion to deny institution or is neutral.

Factor 3 (Investment): Again, the co-pending litigation is in its infancy. Petitioner has recently served preliminary invalidity contentions; and the parties have yet to exchange proposed terms for construction, proposed constructions, or served any *Markman* briefs. At the projected date of institution (October 2023), the fact discovery period will at best be in its early stages, and expert reports still several months out. The Court will almost certainly have not issued any substantive orders relevant to validity by the time of institution. Factor 3 should weigh against exercising discretion to deny institution.

Factor 4 (Overlap): This factor favors institution. To start, Petitioner stipulates that, if IPR is instituted on the grounds presented in this proceeding, Petitioner will not pursue those grounds in the co-pending litigation. Petitioner's contingent stipulation removes the possibility of the Board deciding prior art issues that overlap with invalidity grounds in an earlier jury trial (if any). A stipulation to avoid using instituted grounds in co-pending litigation "mitigates to some degree the concerns of duplicative efforts between the district court and the Board, as well

as concerns of potentially conflicting decisions.” *Sand Revolution*, IPR2019-01393, Paper 24 at 12. Factor 4 weighs against the Board exercising its discretion to deny institution.

Factor 5 (Parties): Because the parties here and in the co-pending litigation are the same, Factor 5 would ordinarily favor denial if trial precedes the Board’s Final Written Decision and favor institution if the opposite is true (due to the 35 U.S.C. 315(e)(2) estoppel provision). Because there is no trial date set, Factor 5 weighs against the Board exercising its discretion to deny institution.

Factor 6 (Merits): The merits of this Petition are particularly strong. The Petition presents multiple prior art combinations against each of the ’864 Patent’s claims. The prior art and arguments at issue here are materially different from those considered by the Examiner during prosecution. The strength of the merits alone is enough to outweigh any inefficiencies. *Fintiv*, IPR2020-00019, Paper 11 at 15.

Based on a holistic view of the *Fintiv* factors, the Board should decline to exercise its discretion under §314(a) to deny the Petition.

VI. PAYMENT OF FEES—37 C.F.R. §42.103

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 06-1050 for the fee set in 37 C.F.R. §42.15(a) for this Petition and

further authorizes payment for any additional fees to be charged to this Deposit Account.

VII. CONCLUSION

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VIII. MANDATORY NOTICES UNDER 37 C.F.R §42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. §42.8(b)(1)

Petitioner, W.R. Grace & Co.-Conn, is the real party-in-interest.

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

The '864 Patent is the subject of a civil action, *G.W. Aru, LLC et al. v. WR Grace & Co. - Conn.*, 1-22-cv-02636 (DMD), Oct. 13, 2022. Petitioner is not aware of any disclaimers, reexamination certificates, or inter partes review petitions for the '864 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioner provides the following designation of counsel.

Lead Counsel	Backup counsel
Timothy W. Riffe, Reg. No. 43,881 Fish & Richardson P.C. 60 South Sixth Street, Suite 3200 Minneapolis, MN 55402 Tel: 202-783-5070 Fax: 877-769-7945 Email: IPR55096-0002IP1@fr.com	Laura C. Whitworth, Reg. No. 74,225 Fish & Richardson P.C. 60 South Sixth Street, Suite 3200 Minneapolis, MN 55402 Tel: 202-783-5070 Fax: 877-769-7945 Email: IPR55096-0002IP1@fr.com

D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR55096-0002IP1@fr.com
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Respectfully submitted,

Dated June 15, 2023

/Timothy W. Riffe/

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(Control No. IPR2023-01063)

Counsel for Petitioner

CERTIFICATION UNDER 37 CFR §42.24

Under the provisions of 37 CFR §42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,991 words, which is less than the 14,000 allowed under 37 CFR §42.24.

Dated June 15, 2023

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on June 15, 2023, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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