

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SYMRISE AG AND SYMRISE INC.

PETITIONER,

v.

INOLEX INVESTMENT CORPORATION,

PATENT OWNER.

IPR2023-01035
Patent 10,995,048

**OPPOSITION TO PATENT OWNER'S REVISED NON-CONTINGENT
MOTION TO AMEND**

TABLE OF CONTENTS

I.	Introduction.....	1
II.	Identification of Claims Being Challenged	1
III.	HOW THE CONSTRUED CLAIMS ARE UNPATENTABLE UNDER 37 C.F.R. §42.104(b)(4).....	1
A.	Overview of the Invalidity Arguments.....	2
IV.	Level of Skill in the Art.....	2
V.	Claims 29-44 are invalid under 35 USC §112	2
VI.	Substitute Claims 29-44 are Invalid as Indefinite	4
VII.	Claims 29-44 are Unpatentable over Wright ‘451	5
A.	PO Failed to Show Unexpected Results.....	5
B.	The Specification and Prosecution History further show that the claimed range is not “critical”	10
C.	Claims 29-44 are obvious over Wright ‘451.....	11
VIII.	Claims 29-44 are Obvious over De Bruyn in view of Takamura.....	16
A.	Motivation to Combine	16
IX.	Patent Owner Estoppel	19
X.	The Substitute Claims are Procedurally Improper	23
XI.	CONCLUSION.....	25

LIST OF EXHIBITS

Exhibit No.	Description
Exhibit 1001	U.S. Patent No. 10,995,048 (“the ’048 Patent”)
Exhibit 1002	Declaration of Dr. Douglass F. Taber
Exhibit 1003	U.S. Provisional Patent Application No. 62/623,985
Exhibit 1004	File History of U.S. Patent No. 10,882,803
Exhibit 1005	File History of U.S. Patent No. 10,995,048
Exhibit 1006	File History of U.S. Patent No. 11,414,365
Exhibit 1007	U.S. Patent Publication No. 2011/0196114A1 (“Le”)
Exhibit 1008	U.S. Patent Publication. No. 2005/0065389A1 (“De Bruyn”)
Exhibit 1009	U.S. Patent Publication. No. 2012/0238788 (“Wright ’788”)
Exhibit 1010	U.S. Patent No. 6,528,665 (“Cheng”)
Exhibit 1011	PCT Written Opinion of the International Searching Authority, PCT/US2015/014943. Issued April 29, 2015
Exhibit 1012	U.S. Patent No. 8,912,373 (“Wright ’373”)
Exhibit 1013	U.S. Patent No. 8,173,850 (“Furuya”)
Exhibit 1014- Exhibit 1019	<i>Reserved</i>
Exhibit 1020	U.S. Patent No. 10,894,750 (“Vecchini”)

Exhibit 1021	U.S. Patent No. 9,908,837 (“Colby”)
Exhibit 1022	U.S. Patent No. 8,765,430 (“Parekh”)
Exhibit 1023	U.S. Patent No. 8,597,922 (“Alibhai”)
Exhibit 1024	U.S. Patent No. 7,795,484 (“Koivusalmi”)
Exhibit 1025	U.S. Patent No. 4,234,752 (“Wu”)
Exhibit 1026	German Patent DE3915493 (“Voeste”) (translation)
Exhibit 1027	N.P Makgoba et al “ <i>Silication of - γ -alumina catalyst during the dehydration of linear primary alcohols,</i> ” Applied Catalysis A: General 297 (2006) 145-150 (“Makgoba”)
Exhibit 1028	W.G. Appleby et al. “ <i>Vapor Phase Dehydration of 1-Heptanol over Activated Alumina,</i> ” J. AM. CHEM. SOC. 66: 1938-1939, 1944 (“Appleby”)
Exhibit 1029	V. I. Komarewsky et al. “ <i>Catalytic Dehydration of 1-Hexanol and 1-Octanol,</i> ” J. AM. CHEM. SOC. 67: 557-558, 1945 (“Komarewsky”)
Exhibit 1030	L. G. Wade, Jr. Organic Chemistry, Chapters 7 and 8 (8th Ed. 2013) (“Wade”)
Exhibit 1031	JAOCS Vol. 62, No. 2, 355-365 (1985) (“Reck”)
Exhibit 1032	JAOCS Vol. 61, No. 2, 343-347 (1984) (“Kreutzer”)
Exhibit 1033	W. E. Schiegl and J. C. Vogel “ <i>Deuterium Content of Organic Matter,</i> ” EARTH AND PLANETARY SCIENCE LETTERS 7:303-313, 1970 (“Schiegl”)
Exhibit 1034	Harmon Craig, “ <i>Standard for Reporting Concentrations of Deuterium and Oxygen-18 in Natural Waters,</i> ” SCIENCE 133: 1833-1834, 1961 (“Craig”)

Exhibit 1035	WO 2001/044145 (“Tiitta”)
Exhibit 1036	U.S. Patent No. 9,029,619 (“Vermeiren”)
Exhibit 1037	WIPO Publication WO 2004/078336 (“Ziehe”)
Exhibit 1038	Second Declaration of Dr. Douglass F. Taber
Exhibit 1039	WIPO Publication WO 2015/130451 (“Wright ’451”)
Exhibit 1040	Deposition Testimony of Michael E. Wright, Ph.D
Exhibit 1041	Sivaraj Chokkaram <i>et al.</i> “ <i>Conversion of 2-octanol over nickel-alumina, cobalt-alumina, and alumina catalysts,</i> ” Journal of Molecular Catalysis A: Chemical 121:157-169, 1997 (“Chokkaram”)
Exhibit 1042	G. G. Cortez <i>et al.</i> “ <i>Study of the Poisoning of γ-Al₂O₃ by Alkali Metals Addition,</i> ” J. Chem. Tech. Biotechnol., 53:177-180, 1992 (“Cortez”)
Exhibit 1043	P. Berteau and B. Belmon “ <i>Modified Aluminas : Relationship Between Activity in 1-Butanol Dehydration and Acidity Measured by NH₃ TPD,</i> ” Catalysis Today, 5:121-137, 1989 (“Berteau”)
Exhibit 1044	EP 2 990 395 B1 to (“Takamura”)
Exhibit 1045	U.S. Patent No. 10,882,803 (“the ’803 Patent”)
Exhibit 1046	Third Declaration of Dr. Douglass F. Taber
Exhibit 1047	Petition in IPR2023-01439
Exhibit 1048	Institution Decision in IPR2023-01439
Exhibit 1049	Judgment in IPR2023-01439

I. Introduction

Petitioner opposes Patent Owner's ("PO") Revised Non-Contingent Motion to Amend ("RMTA") because the Substitute Claims are procedurally improper, PO is estopped from obtaining the Substitute Claims, the Substitute Claims have no written description support, are indefinite, and are unpatentable.¹

II. Identification of Claims Being Challenged

Petitioner asserts that Substitute Claims 29-44 of the '048 Patent are unpatentable based at least on the following grounds:²

Ground	Basis	Basis	Claims Challenged
1	No Written Description Support	§112	29-44
2	Indefiniteness	§112	29-44
3	Wright '451	§103	29-44
4	De Bruyn in view of Takamura	§103	29-44
5	Patent Owner Estoppel	37 CFR §42.73	29-44

III. HOW THE CONSTRUED CLAIMS ARE UNPATENTABLE UNDER 37 C.F.R. §42.104(b)(4)

¹ PO did not file a Response to the Institution Decision or the Opposition to the MTA, therefore, the respective Petition and Opposition demonstrate the respective claims are unpatentable. *See* MTA at 1, FN2.

² Petitioner cannot reasonably raise all grounds of unpatentability for Substitute Claims 29-44 within the 25-page limit for this Opposition. *See* 37 CFR §42.24.

A. Overview of the Invalidity Arguments

The Substitute Claims are not supported by the specification of the '048 patent and are indefinite. The claims are also rendered obvious by the already applied prior art. Finally, PO is estopped from presenting the Substitute Claims.

IV. Level of Skill in the Art.

PO has taken issue with some of Dr. Taber's positions, notably stating that he does not understand the dehydration operation or mechanism. RMTA at 21. No evidence for this is provided. Dr. Wright points to issues that are not disputed or not relevant. For example, Dr. Taber's discussion of using gas or liquid inputs for the reaction. Ex. 2006 at ¶9. Dr. Wright implies Dr. Taber's position is unsupportable and states that "liquid phase reactants never come into contact with the catalyst." Ex. 2006 at ¶9. However, when discussing a reaction in the '048 patent, Dr. Wright testified that "I take this as you're putting a liquid into the reactor..." Ex. 1040 at 156:2-5. When asked "are you always introducing the alcohol into the reactor as a liquid" he answered, "All I can say is most of the work was done that way." Ex. 1040 at 157:10-158:5. So, the critiques appear to be contrived or just interpretative disagreements, not reflecting on Dr. Taber's expertise. Dr. Taber's experience speaks for itself, and none of the citations calls his expertise into question.

V. Claims 29-44 are invalid under 35 USC §112

The Federal Circuit has stated that "to satisfy §112, a patent's written description 'must 'clearly allow persons of ordinary skill in the art to recognize that

[the inventor] invented what is claimed.” *Novozymes v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1346 (Fed. Cir. 2013) (internal citations omitted). PO failed to carry its burden to identify where the subject matter of the Substitute Claims is supported in the ‘048 Patent. 37 CFR §42.121(b)(1) and (d)(1).

Claim 29: “is produced in a conversion of at least 95% % [sic] and has a bio-1-alkene regioselectivity of 95% to about 99% from a single-pass reaction after at least 20 hours time-on-stream”

PO has not carried its burden to show where the specification of the ‘048 patent does not indicate possession of “a conversion of at least 95% % [sic] and has a bio-1-alkene regioselectivity of 95% to about 99%...”. Ex. 1046 at ¶31

Dr. Wright states “Further, it was known that for a specific catalyst, at any given reaction temperature the regioselectivity and conversion are largely a function of flow-rate.” Ex. 2006 at ¶115; Ex. 1046 at ¶32. Yet, despite this being “known”, no flow rate is claimed or disclosed in the ‘048 patent. Because reaction temperature and flow-rate largely control the claimed outcomes, without a disclosure of both flow-rate and temperature, it is not possible for a POSITA to understand that the inventors possessed the Substitute Claims. Ex. 1046 at ¶32.

Furthermore, the ‘048 patent itself is largely silent as to flow-rates. Examples 3, 10, and 11 provide that flow rates are adjusted, but no amount is given. Ex. 1001 at 26:55-67, 28:55-67, and 29:3-11; Ex. 1046 at ¶33. Because there is no disclosure of flow-rates in the ‘048 patent, the inventors did not possess the Substitute Claims.

VI. Substitute Claims 29-44 are Invalid as Indefinite

Substitute Claims 29, says in part “...dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a continuous flow reactor at a temperature of 240 °C to 360 °C with a calcium-promoted γ -alumina catalyst...”. This phrase is indefinite under 35 USC 112(b). The Federal Circuit has stated “Accordingly, a ‘claim is invalid for indefiniteness if its language, read in light of the specification and prosecution history, “fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.”’” 966 F.3d 1374, 1378 (Fed. Cir. 2020) (quoting *Nautilus* , 572 U.S. at 901).

PO has chosen language that does not reasonably inform a POSITA of the scope of the invention. Ex. 1046 at ¶36. The claim language “heating the bio-1-alcohol in a continuous flow reactor at a temperature of 240 °C to 360 °C” has two distinct and incompatible meanings. In one interpretation the claim covers a reactor with a single temperature in the temperature range of 240 °C to 360 °C. The second interpretation is that the 1-alcohol is heated in a reactor that starts at 240 °C and ends at 360 °C, encompassing the claimed temperature range.

The specification of the ‘048 patent supports both interpretations. Ex. 1046 at ¶37. In Examples 3, 4, 5, 10, and 11, the dehydration takes place at a single temperature. *See e.g.*, Ex. 1001 at 26:40-67; 27:12-35; and 28:55-11:25. The specification also discusses that in a single-pass reactor, “the reaction tube is heated

isothermally, the tube having from 1 to 10 reaction zone temperatures along the length of the tube, each heated in the range of about 240 °C to 360 °C in order to optimize catalyst performance.” Ex. 1001 at 15:33-37. Accordingly, a POSITA is not informed with reasonable certainty about the scope of the claim. Ex. 1046 at ¶38.

VII. Claims 29-44 are Unpatentable over Wright ‘451

As the Board has already identified, the Wright ‘451 patent teaches the ranges claimed in the Substitute Claims. Paper 16 at 11. The Substitute Claims still include the ranges taught by Wright ‘451. Accordingly, PO admits, as it must, that the Substitute Claims are presumptively obvious over Wright ‘451. MTA at 18-19.

A. PO Failed to Show Unexpected Results

To rebut a prima facie case of obviousness PO “(1) can establish the existence of unexpected properties in the range claimed” *In re Geisler*, 116 F.3d 1465, 1469 (1997) (internal citations omitted). PO does not rely on “teaching away”. It is undisputed that Wright ‘451 teaches dehydrating a 1-alcohol at 240 °C to 360 °C in a single pass using a catalyst calcined at 200 °C to 600 °C that achieves 95-99% regioselectivity and at least 95% conversion. Ex. 1039 at ¶13, 14, 20, 22, 67, 78, 82; Paper 19 at 11-12; RMTA at 18-20; Ex. 2006 at ¶¶66-70. Ex. 1046 at ¶43.

PO fails to show that the Substitute Claims achieve unexpected results. PO makes two arguments, the claimed temperature and calcination ranges achieve “higher conversion” and “better 1-octene regioselectivity” respectively. RMTA at

19-20; Ex. 1046 at ¶44. Both arguments fail and are not supported by the record.

1. The citations do not show “higher conversion”

PO argues that “[n]othing in Wright ’451 would have taught or suggested to a POSITA that conversion of 1-hexanol would decrease at 370 °C.” RMTA at 20. However, PO fails as an initial matter because Wright ’451 specifically contemplates a dehydration temperature range of 250 °C to 350 °C . Ex. 1039 at [0082]. Unexpected results require PO to claim a narrower range than the prior art.

However, even if PO could rely on unexpected results, the argument relied upon is based on a misinterpretation of an experiment in the ’048 patent. Ex. 1046 at ¶¶45-46. PO relies on Example 11 and the results contained in Table 5. RMTA at 20. Example 11, of the ’048 patent, has three dehydration reactions between 330° C. to 370° C while adjusting the feed rate to maintain 1-2% hexanol exiting the reactor. Ex. 1001 at 29:6-10; *see also* 29:22-25 (explaining formation of additional product); Ex. 1046 at ¶46. Accordingly, the ’048 specification explains that Example 11 was run to maintain conversion of 1-hexanol constant, which is confirmed in Table 5:

TABLE 5					
Catalyst	Reactor Temperature (° C.)	1-Hexene (%)	2-Hexenes & 3-Hexene (%)	1-Hexanol (%)	1-Hexene Selectivity (%)
EXAMPLE 11A	330	92.8	3.5	1.8	95.8
EXAMPLE 11B	350	93.8	3.1	1.7	96.8
EXAMPLE 11C	370	90.1	3.2	1.6	96.6

As can be seen, 1-hexanol is unchanged at the indicated temperatures. So, by design, conversion at 370 °C is unchanged from 330 °C. Ex. 1046 at ¶47.

PO also appears to be relying on the percentages of hexene present in the reaction products, as shown in the columns of Table 5. See RMTA at 19-20 (stating “conversion increased from 93.3% to 96.9%.”); Ex. 1046 at ¶48. To the extent that this is the underlying basis of PO’s arguments, the yield of hexenes resulting from the dehydration reaction is not claimed and cannot be used to show unexpected results. Ex. 1046 at ¶49. Even if it were claimed, it is not clear that the result would be unexpected. This example shows that conversion is consistent with the prior art. The results cited in Wright ‘451 and the results relied on in the ‘048 patent are consistent with the prior art teachings and are not unexpected. Ex. 1046 at ¶50.

2. Claimed Calcination Range Produces Expected Results

PO argues that “a calcium-promoted γ -alumina catalyst calcined at 440 °C provides unexpectedly better 1-octene regioselectivity” RMTA at 19. PO continues “[t]hus, the ‘048 patent demonstrates that the calcination temperature of 500 °C (as taught by Wright ‘451) provides a *less reactive* and *less selective* catalyst than that of the present invention. RMTA at 19 (emphasis in original).³ However, the results tell a different story. Initially, the Board has found that Wright ‘451 teaches a broader range than just 500 °C, and PO concedes as much. RMTA at 18. Focusing on a single

³ Incidentally, while PO emphasizes that the catalyst is “less reactive,” no support is cited, and the ‘048 patent provides no evidence of catalyst reactivity.

temperature in the range taught by Wright ‘451 cannot show unexpected results across the entire temperature range, *i.e.*, 200-600 °C.

PO states that the catalyst calcined at 440 °C “provided a 1-octene regioselectivity of 96.7% at a conversion of 97.2%.” RMTA at 19; Ex. 1046 at ¶52. This is consistent with the teachings by Wright ‘451. Ex. 1039 at ¶13, 14, 20, 22, 67, 78, 82; *see also* RMTA at 18; Ex. 2006 at ¶¶ 22, 66, 72, 76. There is nothing unexpected about the results as they align with prior art teachings. Ex. 1046 at ¶52.

Instead of challenging the teachings of the art head-on, PO instead chooses to compare the claimed range to its own example using a calcination temperature outside the claimed range, *i.e.*, 500 °C. RMTA at 19; Ex. 1046 at ¶53. Results outside the claimed range are insufficient to show unexpected results. *See, e.g., In re Geisler*, 116 F.3d 1465, 1469-1470 (1997). Moreover, and beyond its inapplicability to the test of patentability, it is not even clear that the PO’s assertion that calcination at 500 °C has a negative impact on the reaction is true. *See e.g.*, Ex. 2006 at ¶118 (examples in Wright ‘451 achieve the claimed results at 500°C and greater). Ex. 1046 at ¶54.

PO also fails to address that Wright ‘451 is not the only reference that discusses calcination temperatures and that the background references, *e.g.*, Takamura, Chokkram, Berteau, and Cortez, all inform the background under which a POSITA is evaluating Wright ‘451. *See e.g.*, Ex. 1038 at ¶¶ 22-28 (citing to Exs. 1025, 1041-1044); Ex. 1046 at ¶55; Paper 19 at 11-17.

Specifically, Chokkaram teaches the optimization of calcination between 400 °C and 500 °C. *See* Ex. 1041 at p. 160; Ex. 2006 at ¶47. A POSITA would recognize this discussion as identifying a peak between 400 °C and 500 °C, showing a POSITA the optimum calcination temperature range. Ex. 1038 at ¶¶24-25; Ex. 1046 at ¶56.

Takamura also teaches optimum calcination temperatures for treated gamma-alumina catalysts are between 400 °C and 550 °C, and most preferably at 450 °C. Ex. 1044 at [0057], [0062]; Ex. 1038 at ¶¶25-26; Ex. 1046 at ¶57. Because the prior art of record includes results in the claimed range and outside the claimed range that are consistent with the alleged unexpected results, there is no evidence that any results relied upon by PO are unexpected.

PO's arguments that these references are inapplicable to the current claims are spurious. Chokkaram is relied on for the teachings related to optimized calcination temperature for dehydration of octanol. Ex. 1046 at ¶58. Dr Wright agrees this is disclosed. Ex. 2006 at ¶104 ("Indeed, a POSITA reviewing *Chokkaram* would understand that calcination can be performed at 400 °C."). Similarly, PO addresses Takamura as irrelevant because it discusses "catalytic dehydration of 1-alcohols in liquid solution over a solid catalyst." Ex. 2006 at ¶8. However, Takamura is relied upon to show the dehydration of primary alcohols to create an olefin in high yield using a modified γ -alumina catalyst. Ex. 1044 at [0019], [0027]; Ex. 1046 at ¶59. These teachings directly impact the Substitute Claims. For example, Takamura

explains dehydrating a 1-alcohol using a modified γ -alumina catalyst with 1-3% metal oxide after calcining at 450 °C yields the desired olefin in excess of 95%, which is consistent with prior art and the Substitute Claims. Ex. 1044 at [0008], [0037], [0051]-[0055]; Ex. 1046 at ¶60. Prior art is prior art for all that it teaches, and a POSITA understands the similarities and differences. Ex. 1046 at ¶61.

Furthermore, in both of Dr. Wright's Declarations he indicates that the expected regioselectivity is consistent from 400 °C to 500 °C, above which he opines changes in the results could begin to appear. Ex. 2001 at ¶ 65 (stating that a "calcining ceiling temperature" is "a truly unexpected result"); Ex. 2006 at ¶21. Dr. Wright states that "this remarkable regioselectivity and conversion is provided by heating the bio-1-alcohol in a reactor with a γ -alumina catalyst treated with a calcium promoter and then calcined at a temperature of about 400 °C to about 480 °C". Ex. 2006 at ¶21. However, if the same results are achieved through a range that is broader than the claimed range, i.e., 400 °C to 420 °C is unclaimed, this is evidence of consistent results with the prior art throughout the claimed range, not unexpected.

B. The Specification and Prosecution History further show that the claimed range is not "critical"

In determining whether the range is "critical" courts have also reviewed the specification and prosecution history to determine if the Applicant had indicated the criticality of certain features. *In re Shepard*, 319 F.2d 194, 199 (CCPA 1963).

The specification and prosecution history did not indicate the range was

“critical.” The reason for allowance and focus of the prosecution was “dehydrating an alcohol by heating.” Ex. 1005 at 206. The specification of the ‘048 patent also fails to provide information showing that the claimed range is “critical” to the process. Accordingly, the prosecution history and specification of the ‘048 patent confirm that there is nothing “critical” about the claimed range of 420 °C to 480 °C.

The original claims of the ‘048 patent do not indicate that the calcination temperature is “critical,” only mentioning a claimed calcination temperature range in claim 18. *See e.g.*, Ex. 1001 at claim 18. Claims regarding higher regioselectivity, *e.g.*, claim 10 stating “regioselectivity of about 95% to about 99%”, do not depend on a claim with any specific calcination temperature required. *See e.g.*, Ex. 1001 at claim 10. Conversion was not originally claimed. Accordingly, the original claims indicate that the results are achievable without the claimed calcination temperature.

Petitioner has shown, and the Board has found, that the claimed regioselectivity was known. Institution Decision at 14-15, 21; Paper 16 at 11-14. Further, PO had earlier conceded that the claimed regioselectivity range was known and is estopped from arguing otherwise. *See* Ex. 1049 (Disclaimed Claim 11 states “wherein the bio-alkene have a bio-1-alkene regioselectivity of about 95% to 99%). Accordingly, there are no unexpected results.

C. Claims 29-44 are obvious over Wright ‘451

PO has admitted that claims 29-44 are presumed obvious because the

Substitute Claims and Wright '451's teachings only differ based on narrower reaction temperature and calcination temperature ranges. RMTA at 18-20; Ex. 1046 at ¶62. However, because, as demonstrated above, there are no unexpected results within the narrower ranges, Substitute Claims 29-44 are obvious over Wright '451.

29. A method for making a bio-alkene, comprising: dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a continuous flow reactor at a temperature of 240 °C to 360 °C with a calcium-promoted γ -alumina catalyst calcined at a temperature of about 420 °C to about 480 °C, wherein the catalyst has not been silanized, and

Wright '451 discloses a dehydration process in a continuous flow reactor for the "conversion of terminal alcohols to the corresponding terminal alkenes with high regioselectivity at high conversion." Ex. 1039 at [0002], [0016], [0017], [0020]; RMTA at 18; Ex. 1046 at ¶63; Paper 16 at 11-12. The γ -alumina is "...modified with Ca^{+2}" Ex. 1039 at [0014], [0066]. Wright '451 also teaches that the γ -alumina catalyst, after modification, is calcined at 200 °C to 600 °C. Ex. 1039 at [0067]; *see also* [0065]; Ex. 1038 at ¶¶22-28, 63; Ex. 1040 at 110:3-117:11, 120:11-121:10; Ex. 1046 at ¶63. Further, the dehydration reaction takes place between 220 °C to 440 °C. Ex. 1039 at [0013], [0049], [0077]. Silanization is not undertaken here.

Accordingly, Wright '451 teaches each feature of the claim. Ex. 1046 at ¶64.

wherein the resulting bio-alkene has a carbon chain of 6 to 10 carbon atoms and is produced in a conversion of at least 95% %

[sic] and a bio-1-alkene regioselectivity of 95% to about 99% from a single-pass reaction after at least 20 hours time-on-stream.

Wright '451 teaches a single pass dehydration reaction that achieves a bio-1-alkene regioselectivity of 95% to about 99% at a 95% alcohol conversion. Ex. 1046 at ¶65; Paper 16 at 11-12. Wright '451 teaches a 6 to 8 carbon "bio-1-alkene" product that results from a single pass dehydration reaction that takes place at 220-440 °C and achieves a "chemical conversion of greater than about 95%" and produces a "terminal olefin" "with about 90% to 99% regiochemical selectivity." Ex. 1039 at [0013], [0022]; [0078]; [0082], [0083]; Ex. 1038 at ¶¶65-69; ¶67; Ex. 1040 at 106:11-107:12; 109:2-19; 119:3-120:3; Ex. 1046 at ¶65; *see also* Ex. 1039 at Table 1 and Table 2 at Examples 3, 8, 12, 13, 16-19. This regioselectivity and conversion is maintained for a TOS of "up to 48 months". Ex. 1039 at [0050]; *see also* [0015], [0075], [0076]. Accordingly, Wright '451 teaches dehydration reactions that achieve at least 95% conversion and at least 95% regioselectivity to bio-1-alkenes having a carbon chain between 6 and 8 atoms long in a single pass after at least 20 hours time on stream. Ex. 1038 at ¶68; Ex. 1046 at ¶66.

3. Claims 30-32

30/[31]. The method of claim 29, wherein the bio-alkene has a carbon chain of 6 to 8 [6] carbon atoms.

32. The method according to claim 29, wherein the bio-alkene is bio-octene.

As discussed above with respect to claim 29, Wright '451 teaches dehydrating

bio-1-hexanol and bio-1-octanol. Ex. 1039 at [0078] (general formula for alcohols); Ex. 1046 at ¶67; Paper 16 at 11-12. The resulting bio-1-alkene will have the same carbon chain length as the initial bio-1-alcohol. Accordingly, Wright '451 discloses the bio-alkene has a carbon chain of 6 to 8. Ex. 1038 at ¶¶ 69-71.

4. Claims 33, 36, 39, 42

33[/36/39/42]. The method according to claim 29[/30/31/32], wherein the calcium-promoted γ -alumina has a CaO content of about 1% to about 2%.

Wright '451 teaches calcium-promoted γ -alumina having a CaO content of 1% to 2%. Wright '451 at [0014], [0031]. [0032].[0065], [0067] (Ca^{+2} in the range of 0.8 to 2.0 wt%); see also Ex. 1039 at [0093]-[0118]; Ex. 1046 at ¶68; Paper 16 at 11-12. Accordingly, Wright '451 discloses 1.0 to 1.7 wt% CaO content.

5. Claims 34, 37, 40, 43

34[/37/40/43]. The method according to claim 33[/36/39/42], wherein prior to the dehydrating, the calcium-promoted catalyst has been calcined at a temperature of about 440 °C to about 460 °C.

Initially, this claim reads on all γ -alumina catalysts. As noted by PO, it was known that “a wide range of temperatures can be used to calcine precipitates in order to prepare alumina from aluminates.” Ex. 2006 at [0047] (known calcination temperatures include 723K (450 °C)); Ex. 1046 at ¶69; Paper 16 at 11-12. Accordingly, prior to treatment with calcium, which is prior to dehydration, the

catalyst has been calcined at 440-460 °C.

Further, Wright '451 discloses that the catalyst is calcined, prior to the dehydration reaction of alcohols, at temperature ranges that include 420 °C to 480 °C. Ex. 1039 at [0014], [0015], [0035], [0042], [0043], [0045], [0067], [0093]-[0095], [0098], [0100], [0102]-[0104], [0107]-[0111]; FIG. 2; Ex. 1038 at ¶¶22-28, 74, 75, 80, 81, 86, 87, 93, 94; Ex. 1046 at ¶70. As discussed above, there are no unexpected results within the claimed range. Accordingly, Wright '451 discloses prior to the dehydrating, calcining the catalyst at a temperature of about 440 °C to about 480 °C and the bio-alkene has a carbon chain of 6 to 8 carbon atoms. Ex. 1038 at ¶¶76, 82, 88, 95; Ex. 1046 at ¶71.

6. Claims 35, 38, 41, 44

35[/38/41/44]. The method according to claim 34[/37/40/43], wherein the reactor is heated at a temperature of 315 °C to 350 °C.

Wright '451 discloses after calcining at 440 °C to about 460 °C running a dehydration reaction at about 240 °C to about 360 °C producing the claimed results. Ex. 1039 at [0067], [0077], [0078], [0082] (disclosing range of 250 °C to 350 °C); Ex. 1046 at ¶72; Paper 16 at 11-12. The examples include reactions run at 340 °C. See *e.g.*, Ex. 1039 at [0042]-[0045], FIGs. 9-12. Further, PO does not identify any unexpected results. Accordingly, by the reaction operating as expected within the claimed range, Wright '451 renders the claimed reaction temperature range obvious.

VIII. Claims 29-44 are Obvious over De Bruyn in view of Takamura

A. Motivation to Combine

De Bruyn and Takamura are both references addressing the dehydration of 1-alcohols to the 1-alkene at high conversion and regioselectivity. Ex. 1044 at [0008]; Ex 1008 at [0035]; Ex. 1046 at ¶73. Further, De Bruyn states that the process to provide the desired dehydration are well known, and not explained in great detail. Ex. 1008 at [0037]. Accordingly, a POSITA would look to Takamura as one of the references that provides the further details about how to implement the promoted alumina catalyst discussed by De Bruyn. Ex. 1046 at ¶73. For example, a POSITA wanting to prepare the promoted catalyst to enhance the dehydration reaction rate while preventing reduction of surface area and maintaining dispersion of the catalyst, would consult the preparation steps of Takamura to make the catalyst. Ex. 1044 at [0057], [0062] A POSITA would impregnate, dry, calcine, and then use the catalyst to dehydrate the alcohol and achieve high conversion and regioselectivity. Ex. 1044 at [0056]-[0065]; Ex. 1046 at ¶73. Further Takamura teaches that the amount of promoter should be between 1 and 3% to enhance the reaction rate while suppressing side reactions. Ex. 1044 at [0054]. Takamura explains the desired properties of the catalyst so that a POSITA can check the prepared catalyst to confirm it is within desired ranges. Ex. 1044 at [0066]-[0072].

29. A method for making a bio-alkene, comprising: dehydrating a bio-1-alcohol by heating the bio-1-alcohol in a continuous flow

reactor at a temperature of 240 °C to 360 °C with a calcium-promoted γ -alumina catalyst calcined at a temperature of about 420 °C to about 480 °C, wherein the catalyst has not been silanized, and

De Bruyn teaches a dehydration reaction for 1-hexanol and 1-octanol, involving a calcium promoted γ -alumina catalyst, at 250 °C to 350 °C, that has not been silanized. Ex. 1008 at [0037], [0053], [0068]-[0071], [0081]-[0083]; Ex. 1046 at ¶74; Paper 16 at 13-14. When determining how to treat the catalyst, Takamura explains to a POSITA that the aluminum oxide should support between 1-3% of the support element (*e.g.*, the calcium of De Bruyn) to enhance the dehydration rate while suppressing side reactions. Ex. 1044 at [0054]. Further, Takamura states that the catalyst can be prepared via an impregnation process that is subsequently dried and calcined at between 400 °C to 550 °C, most preferably at 450 °C. Ex. 1044 at [0057], [0063]. This range provides enhancement of the dehydration reaction through the provision of a sufficient surface area maintenance of the degree of dispersion of the catalyst. Ex. 1044 at [0057], [0063]; Ex. 1046 at ¶75.

Wherein the resulting bio-alkene has a carbon chain of 6 to 10 carbon atoms and is produced in a conversion of at least 95% % [sic] and a bio-1-alkene regioselectivity of 95% to about 99% from a single-pass reaction after at least 20 hours time-on-stream.

De Bruyn in view of Takamura teaches a single pass dehydration reaction that

achieves a bio-1-alkene regioselectivity of 95% to about 99% at a 95% alcohol conversion. Ex. 1046 at ¶76 De Bruyn in view of Takamura teaches greater than 95% conversion of the 1-alcohol with a regioselectivity of greater than 97%. Ex. 1008 at [0037], [0053]; Ex. 1044 at [0081]; Paper 16 at 13-14. Takamura further that the reaction time can be adjusted to provide an alcohol conversion of greater than 95%. Ex. 1044 at [0081]. Accordingly, the catalyst of De Bruyn in view of Takamura teaches the results in a single-pass reaction after 20 hours TOS, as that is a design choice based on scale. Ex. 1046 at ¶76. Industrial processes, like De Bruyn, optimize differently than smaller scale reactions, and the combination of De Bruyn and Takamura alter the reaction time to achieve the desired results. Ex. 1046 at ¶¶76-77.

1. Claims 30-32

30/[31]. The method of claim 29, wherein the bio-alkene has a carbon chain of 6 to 8 [6] carbon atoms.

32. The method according to claim 29, wherein the bio-alkene is bio-octene.

De Bruyn in view of Takamura teaches dehydrating 1-hexanol and 1-octanol. Ex. 1008 at [0037], [0053], [0068]-[0071], [0081]-[0083]; Ex. 1046 at ¶78; Paper 16 at 13-14.

2. Claims 33, 36, 39, 42

33/[36/39/42]. The method according to claim 29/[30/31/32], wherein the calcium-promoted γ -alumina has a CaO content of about 1% to about 2%.

De Bruyn in view of Takamura teaches calcium-promoted γ -alumina with 1% to 2% CaO content. Ex. 1008 at [0037]; Ex. 1044 at [0054]; Ex. 1046 at ¶79.

3. Claims 34, 37, 40, 43

34[/37/40/43]. The method according to claim 33[/36/39/42], wherein prior to the dehydrating, the calcium-promoted catalyst has been calcined at a temperature of about 440 °C to about 460 °C.

De Bruyn in view of Takamura teaches preparing the γ -alumina catalyst via a standard impregnation process and subsequently calcining at between 400 °C to 550 °C, most preferably at 450 °C. Ex. 1044 at [0057], [0063]; Ex. 1046 at ¶80; Paper 16 at 13-14.

4. Claims 35, 38, 41, 44

35[/38/41/44]. The method according to claim 34[/37/40/43], wherein the reactor is heated at a temperature of 315 °C to 350 °C.

De Bruyn in view of Takamura teaches a dehydration reaction for 1-hexanol and 1-octanol at 250 °C-350 °C. Ex. 1008 at [0037], [0053], [0068]-[0071], [0081]-[0083]; Ex. 1044 at [0078]-[0079]; Ex. 1046 at ¶81; Paper 16 at 13-14.

IX. Patent Owner Estoppel

PO has disclaimed claims 1-7, 9-11, 24-26, 28, 29, 35, and 36 of US Pat. No. 10,882,803, the “Disclaimed Claims”. Ex. 1049; Ex 1047, 1048. The Board has entered an adverse judgment against PO based on the disclaimer. PO is “precluded from taking action inconsistent with the adverse judgment”. 37 CFR 42.73(d)(3).

Estoppel applies when a claim is not “patentably distinct” from a finally refused or canceled claim. 37 CFR 42.73(d)(3)(i). The test for patentably distinct looks at the “differences in subject matter between the claims” and then undertakes an “analysis [that] is analogous to an inquiry into the obviousness of a claim under 35 USC §103.” *Abbvie Inc. v. Mathilda & Terence Kennedy Inst. of Rheumatology Trust*, 764 F.3d 1366, 1378-79 (Fed. Cir. 2014); *see also Apple Inc. Requester & Cross-Appellant, v. Softview LLC Pat. Owner & Appellant.*, No. APPEAL 2021-005530, at *10 (P.T.A.B. Sept. 22, 2022)(confirming patentably distinct for 42.73(d)(3)(i) is “in the obviousness sense.”); *MaxLinear*, 880 F.3d at 1377 (if differences “materially alter” invalidity).

The Substitute Claims are not patentably distinct from the Disclaimed Claims, as they are, at best, obvious variants of the Disclaimed Claims and/or are taught by the prior art. PO failed to identify any differences between the Disclaimed Claims and Substitute claims, so Petitioner speculates that the differences are reaction temperature, calcination temperature, single-pass, and time-on-stream (TOS).

First, even PO does not argue that single-pass or TOS are patentable distinctions. RMTA at 18-20; Ex. 1046 at 22. If the conversion to 1,2-alkanediol is considered a difference, that difference is obvious as the only “disclosed utility” of the ‘803 specification for the 1-alkene. *Abbvie Inc. v. Mathilda & Terence Kennedy Inst. of Rheumatology Trust*, 764 F.3d 1366, 1380-1381 (Fed. Cir. 2014).

The remaining differences, *i.e.*, reaction temperature and calcination temperature, are obvious variants of the Disclaimed Claims and are not patentably distinct. The Disclaimed Claims include heating a reactor with a γ -alumina catalyst to achieve 95-99% regioselectivity of the 1-alkene. *See e.g.*, Claims 1, 6, 7, 9, 11. The specification of the '803 patent provides only one viable temperature range to achieve this outcome, 240 °C to 360 °C. Ex. 1045 at 5:66-6:2; 15: 26-41; 27:16-18; 28:46-50; 29:8-11; 29:57-59; Ex. 1046 at ¶21. Further, the '803 specification only provides one viable catalyst, a calcium promoted γ -alumina catalyst that is calcined between 400 °C to 500 °C to achieve the 95-99% regioselectivity. Ex. 1045 at 8:35-51, 9:17-23, 9:38-44; 14:45-53; 15:48-56; 17:16-35; Ex. 1046 at ¶¶23, 24. Accordingly, because the scope of the Disclaimed Claims fully encompasses the Substitute Claims with no identified patentable distinctions or unexpected results, PO is estopped from asserting patentability of the Substitute Claims. Disclaiming the process of the Disclaimed Claims allows the public to practice the process of the Disclaimed Claims; the specification only provides the above-described parameters for achieving the regioselectivity of the Disclaimed Claims. Accordingly, the process in view of the specification is not patentably distinct. Further, the differences between the Disclaimed Claims and the Substitute Claims are known in the art and, therefore, would not raise to the level of a patentable distinction. Ex. 1046 at ¶25.

PO admits and the Board has found that the claimed dehydration temperature

range is known in the art. *See e.g.*, RMTA at 20 (temperatures of 220 °C-440 °C); Ex. 2001 at ¶45; Ex. 2006 at ¶42; ¶48; ¶120; Ex. 1046 at ¶26; Paper 7 at 11, 13; Paper 16 at 11-15. PO also admits and the Board has found that this calcination temperature range was known. RMTA at 18; Ex. 2001 at ¶19; Ex. 2006 at ¶¶ 22, 66, 72, 76; Paper 16 at 11-15. Finally, PO has admitted that Wright ‘451 teaches single-pass over a catalyst to achieve 95% conversion. Ex. 1040 at 107:4-12; Ex. 1046 at ¶26. TOS appears to be an inherent property of the catalyst. RMTA at 8 (29f). Accordingly, the differences between the Disclaimed Claims and the Substitute Claims are not patentable distinctions but instead known in the prior art.

Finally, as stated above, not only were these differences known in the art, Dr. Wright attempted to claim the same subject matter previously. Ex. 1039 at 34-38. Dr. Wright’s Declaration argues that the Substitute Claims are patentable over Wright ‘451, but this is directly contradicted by the claims of Wright ‘451 that Dr. Wright filed as patentable and includes the subject matter that is now at issue. Ex. 2006 at ¶¶117-128; Ex. 1039 at 34-38. Dr. Wright’s Declaration related to representations that question the validity of the claims filed with Wright ‘451 should be given no weight, as he attested to their validity when filed.

In addition, issue preclusion also prevents PO from arguing for the patentability of the Substitute Claims. The issues at stake are identical, were actually litigated, the issue was critical, and PO had an opportunity to litigate the issue. *Aspex*

Eyewear, Inc. v. Zenni Optical Inc., 713 F.3d 1377, 1380 (Fed. Cir. 2013). Accordingly, issue preclusion prevents PO from arguing the patentability of the Substitute Claims because of the disclaimer of the Disclaimed Claims. Accordingly, PO is estopped and precluded from the Substitute Claims. Ex. 1046 at ¶27.

X. The Substitute Claims are Procedurally Improper

PO has failed to meet the requirements of 37 CFR §41.121, or in the alternative, the Board should deny the RMTA due to the PO's consistent disregard for its duties to the Office. IPR2021-00847, Paper 133 at 6.

PO has now filed three claim sets, *i.e.*, the Original Claims, a Motion to Amend (“MTA”), and the RMTA, each included claims that PO knew, or should have known, were obvious when filed. Despite this, PO has forced the Board and Petitioner to spend an extraordinary amount of resources showing the Substitute Claims are invalid, even though PO now admits these claims were obvious when filed. For example, PO now admits that Wright ‘451 is the closest prior art of record and renders the MTA and RMTA claims obvious. RMTA at 19-20; *compare* MTA at 19 (asserting Wright ‘788 as the closest prior art). However, Wright ‘451 patent was filed by the same inventor as the ‘048 patent, Dr. Michael Wright, and the Wright ‘451 patent was known to PO since at least 2015. Ex. 1040 at 130:16-20 (“I have to admit I sort of looked at this. I knew this was coming. It's no surprise. ... So I knew this would come up.”). Further, Dr. Wright attempted to claim the same

subject matter previously in Wright ‘451. *See e.g.*, Claims 1 (reaction), 10 (alcohol), 12 (conversion), 13 (regioselectivity), 22 (temperature), 38 (calcium), 46 (calcining modified catalyst). Yet, despite this known material prior art against each of the claim sets, PO failed to disclose or distinguish the prior art when filing the MTA.

Noticeably, PO only tried to distinguish “prior art of record” in each of its filings. MTA at 11. However, PO is required to do more. For example, PO’s related ‘803 patent had claims that included “heating the γ -alumina catalyst with a base comprising a Group I or a Group II metal; and heating the γ -alumina catalyst to a temperature of about 400°C to about 500°C.” Ex. 1004 at 5 of 617. This claim was rejected over a different Wright reference, i.e., WO2016/007196 to Wright et al (Wright ‘196), that the Examiner alleged to teach the recited features. Ex. 1004 at 127 of 617 (teaching calcium promoted γ -alumina catalyst, calcined at 100 °C to 900 °C) Accordingly, PO was on notice since at least August 6, 2019, that Dr. Wright had additional prior art that was material to patentability and discloses similar teachings to what PO now admits renders the current claims presumptively obvious.

Further, PO now admits that both De Bruyn and Wu achieve results that render the Original Claims and MTA Claims obvious. Ex. 2006 at ¶¶60, 75, 88, 106 (distinguishing on unclaimed grounds); ¶106 (citing example 10). Accordingly, De Bruyn and Wu were known material prior art references.

The Board has stated that “Information about an added limitation may be

material even if it does not include the rest of the claim limitations.” *Lectrosonics, Inc. v. Zaxcom, Inc.*, Case IPR2018-01129, -01130, slip op. at 9-10 (PTAB Feb. 25, 2019) (Paper 15) (precedential). Accordingly, Petitioner requests that the Board deny the RMTA based on failure to respond to a ground of unpatentability under with 37 CFR 42.121 or, in the alternative, requests the Board deny the RMTA for failing to disclose and address known material references. PO objectively failed to disclose Wright ‘451 or distinguish Wright ‘196, Wu, and DeBruyn. Known prior art needs to be disclosed and addressed by PO. The RMTA should be denied.

XI. CONCLUSION

In view of the foregoing, Substitute Claims 29-44 of the ’048 Patent are not patentable, and Petitioner requests the RMTA be denied, the claims are not patentable over the prior art, the claims are not supported in the originally filed specification, are indefinite, and PO is estopped from arguing otherwise.

Date: July 25, 2024

Respectfully submitted,

/James P. Murphy/
James P. Murphy, Reg. No. 55,474
Polsinelli, PC
1000 Louisiana Street, Suite 6400
Houston, Texas 77002
Tele: (713) 374-1631
Fax: (713) 374-1601

CERTIFICATE OF SERVICE UNDER 37 CFR §42.6(e)(4)

The undersigned hereby certifies that a copy of the accompanying Opposition to PO Revised Motion to Amend, all accompanying exhibits, has been served via email on July 25, 2024, upon the following service email addresses provided in Patent Owner's mandatory notices:

Aaron Lukas
alukas@cozen.com

William Coblentz
wcoblentz@cozen.com

Mark Boezi
mboezi@cozen.com

/Ericka McNeil/
Ericka McNeil
Polsinelli, PC
1000 Louisiana Street, Suite 6400
Houston, Texas 77002
Tele: (713) 374-1600
Fax: (713) 374-1601