

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Symrise AG and Symrise Inc.,
Petitioner,

v.

Inolex Investment Corp.,
Patent Owner

IPR2023-01035
U.S. Patent No. 10,995,048

THIRD DECLARATION OF DOUGLASS F. TABER

TABLE OF CONTENTS

I.	Introduction	4
II.	Materials Reviewed.....	5
III.	SUMMARY OF MY OPINIONS.....	8
IV.	Legal Principles.....	9
A.	Level of Ordinary Skill in the Art.....	11
V.	The Disclaimed ‘803 claims are not Patentably Distinct from the current Substitute Claims	12
VI.	Claims 29-44 are invalid under 35 USC §112	16
VII.	Substitute Claims 29-44 are Invalid as Indefinite under 35 U.S.C. §112(b)	18
VIII.	Claims 29-44 are Unpatentable over Wright ‘451	19
A.	Inorex Failed to Show Unexpected Results	20
B.	The ‘048 patent does not show “higher conversion”	21
C.	Claimed Calcination Range has Expected Results	23
D.	Claims 29-44 are obvious over Wright ‘451.....	26
1.	Claims 30-32.....	28
2.	Claims 33, 36, 39, 42.....	29
3.	Claims 34, 37, 40, 43.....	29
4.	Claims 35, 38, 41, 44.....	30
IX.	Claim 29-44 are Obvious over De Bruyn in view of Takamura.....	31
A.	Motivation to Combine	31
1.	Claims 30-32.....	34
2.	Claims 33, 36, 39, 42.....	34
3.	Claims 34, 37, 40, 43.....	35

4.	Claims 35, 38, 41, 44.....	35
X.	Conclusion.....	36
XI.	Oath	37

I, Dr. Douglass F. Taber, declare as follows:

I. INTRODUCTION

1. I have been retained on behalf of Symrise AG and Symrise Inc. (collectively “Petitioner”) in connection with the above captioned *Inter Partes* Review (IPR) of U.S. Patent No. 10,995,048 (’048 Patent). I have been asked to study and provide my opinions as an independent expert witness regarding technology described in the ’048 Patent. I am being compensated at my usual and customary rate for my time. Such compensation, however, does not influence my opinion nor does the outcome of this proceeding impact my compensation.

2. I have carried out research in organic chemistry and taught graduate and undergraduate classes on organic chemistry, including organic reaction mechanisms, throughout my 40-year career. I have published more than 200 research articles. In 2023, 72 of those articles were cited by other research groups, 24 of them more than once. I am the author of the weekly online scientific publication, *Organic Synthesis Highlights*, used by research groups all around the world.

3. I have conducted research and published scholarly papers on the preparation and reactions of alkenes, alcohols, epoxides, and esters. These have included the dehydration of alcohols to the corresponding alkenes with the control of regioselectivity. In fact, I published a new protocol for the conversion of a 1-

alkene to the corresponding 1-epoxide. Throughout my career I have routinely used the conversion of an epoxide to the corresponding 1,2-diol. I maintain a database of the most important organic chemical transformations, which currently contains more than 60,000 entries, any one of which I can access in minutes.

4. A copy of my *curriculum vitae* is attached as Appendix A. It includes a list of testimony I have provided in other legal proceedings, an outline of my research experience, and a list of my publications.

II. MATERIALS REVIEWED

5. In forming my opinions provided in this declaration, I have read and considered the items listed in the table below. I have also relied on my education, knowledge, and experience in organic chemical synthesis.

Document Reviewed	
1.	U.S. Patent No. 10,995,048 (“ the ’048 Patent ”) and the corresponding prosecution history of U.S. Application No. 16/682,059
2.	U.S. Patent Publication No. 2011/0196114 (“ Le ”)
3.	WIPO Publication WO 03/024910 (“ De Bruyn ”)
4.	U.S. Patent No. 10,894,750 (“ Vecchini ”)
5.	WIPO Publication WO 2004/078336 (“ Ziehe ”)
6.	U.S. Patent No. 8,173,850 (“ Furuya ”)
7.	W.G. Appleby <i>et al.</i> “Vapor Phase Dehydration of 1-Heptanol over Activated Alumina,” J. AM. CHEM. SOC. 66: 1938-1939, 1944 (“ Appleby ”)

Document Reviewed	
8.	V. I. Komarewsky <i>et al.</i> “Catalytic Dehydration of 1-Hexanol and 1-Octanol,” J. AM. CHEM. SOC. 67: 557-558, 1945 (“ Komarewsky ”)
9.	L. G. Wade, Jr. Organic Chemistry (8 th Ed. 2013) (“ Wade ”)
10.	Daniel Swern <i>et al.</i> “Hydroxylation and Epoxidation of Some 1-Olefins with Per-acids,” J. AM. CHEM. SOC. 68, 1504-1507, 1946 (“ Swern ”)
11.	Kuladip Sarma <i>et al.</i> “Rapid 1,2-dihydroxylation of alkenes using a lipase and hydrogen peroxide under microwave conditions,” TETRAHEDRON LETTERS 48 (2007) 6776-6778 (“ Sarma ”)
12.	Azhong Wang <i>et al.</i> “Palladium-Catalyzed Diacetoxylation of Alkenes with Molecular Oxygen as Sole Oxidant,” J. AM. CHEM. SOC. 131: 3486, 2009 (“ Wang ”)
13.	William E. Fristad and John R. Peterson “Iron(III) Catalyzed Persulfate Oxidation of Alkenes to Vicinal Diacetates,” TETRAHEDRON LETT. 24: 4547-4550, 1983 (“ Fristad ”)
14.	Chi-Ming Ho <i>et al.</i> “Ruthenium Nanoparticles Supported on Hydroxyapatite as an Efficient and Recyclable Catalyst for <i>cis</i> -Dihydroxylation and Oxidative Cleavage of Alkenes,” ANGEW. CHEM. INT. ED. 43:3303-3307, 2004 (“ Ho ”)
15.	Isao Sakurada <i>et al.</i> “Dichlorotin oxide-catalyzed new direct functionalization of olefins: synthesis of <i>trans</i> β -azidohydrins and 1,2-diols,” TETRAHEDRON LETT. 41: 2415-2418, 2000 (“ Sakurada ”)
16.	Wolfgang A. Herrmann <i>et al.</i> “Methyltrioxoruthenium as Catalyst for Olefin Oxidation,” ANGEW. CHEM. INT. ED. 30:1638-1641, 1991 (“ Herrmann ”)
17.	David R. Williams <i>et al.</i> “Total Synthesis of (-)-Ratjadone,” ORG. LETT. 3: 1383, 2001 (“ Williams ”)

Document Reviewed	
18.	Waldemar Adam and Lluís Blancafort “ <i>Steric and Stereoelectronic Control of the Mode of Selectivity as a Function of Alkene Structure in the Reaction with Dimethyl α-Peroxy Lactone: Cycloadducts and Ene Products versus Epoxides</i> ,” J. AM. CHEM. SOC. 118: 4778-4787, 1996 (“ Adam ”)
19.	N. Miyaura and J. K. Kochi “ <i>Chromyl Complexes in the Direct Epoxidation of Alkenes</i> ,” J. AM. CHEM. SOC. 105: 2368-2378, 1983 (“ Miyaura ”)
20.	W. E. Schiegl and J. C. Vogel “ <i>Deuterium Content of Organic Matter</i> ,” EARTH AND PLANETARY SCIENCE LETTERS 7:303-313, 1970 (“ Schiegl ”)
21.	Harmon Craig, “ <i>Standard for Reporting Concentrations of Deuterium and Oxygen-18 in Natural Waters</i> ,” SCIENCE 133: 1833-1834, 1961 (“ Craig ”)
22.	U.S. Patent No. 9,029,619 (“ Vermeiren ”)
23.	U.S. Patent No. 9,908,837 (“ Colby ”)
24.	U.S. Patent No. 8,765,430 (“ Parek ”)
25.	U.S. Patent No. 8,597,922 (“ Alibhai ”)
26.	JAOCS Vol. 62, No. 2, 355-365 (1985) (“ Reck ”)
27.	JAOCS Vol. 61, No. 2, 343-347 (1984) (“ Kreutzer ”)
28.	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 ”)
29.	U.S. Patent No. 7,795,484 (“ Koulisalmi ”)
30.	WO 2001/044145 (“ Tiitta ”)
31.	U.S. Patent No. 4,234,752 (“ Wu ”)
32.	German Patent DE3915493 (“ Voeste ”) (translation)

Document Reviewed	
33.	EP 2 990 395 B1 to (“ Takamura ”)
34.	WIPO Publication WO 2015/130451 (“ Wright ’451 ”)
35.	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 ”)
36.	G. G. Cortez <i>et al.</i> “Study of the Poisoning of γ -Al ₂ O ₃ by Alkali Metals Addition,” J. Chem. Tech. Biotechnol., 53:177-180, 1992 (“ Cortez ”)
37.	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 ”)
38.	Deposition Testimony of Michael E. Wright, Ph.D (“ Wright Deposition ”)

III. SUMMARY OF MY OPINIONS

6. I understand the following table summarizes the grounds of challenge (“Grounds”) raised in the Opposition:

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

7. After a review of the '048 Patent, the Substitute Claims, and the prior art, it is my opinion that the Substitute Claims are invalid under the proposed Grounds. My opinions, and the bases for my opinions, are detailed throughout this Declaration.

IV. LEGAL PRINCIPLES

8. I am not an attorney and will not be offering legal conclusions. However, I have been informed of several principles concerning legal issues relevant to my analysis of the Challenges to the claims of the '048 Patent, and I relied on these principles to arrive at my conclusions.

9. I understand a claim is anticipated if all limitations are found in a single prior art reference, arranged as in the claim. The identical invention must be shown in as complete detail as is contained in the patent claim.

10. I understand a prior art reference can disclose an element not expressly identified in a reference if the element is “inherently present” in the reference. To be “inherent,” I understand the missing element must necessarily be present in the reference. An element is not “inherent” if the missing element is only probably present or if there is merely a possibility it is present.

11. I understand a claim is invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented and the prior art are such that the subject matter of the claim as a whole would have been obvious

at the time of the patent's filing date to a Person of Ordinary Skill in The Art (POSITA). It is my understanding that the following factors are used to determine whether or not the claimed subject matter would have been obvious: (i) the scope and content of the prior art; (ii) the differences between the prior art and the claimed invention; (iii) the level of ordinary skill in the field of the invention; and (iv) any relevant objective considerations of non-obviousness.

12. I understand a party asserting obviousness based on a combination of prior art references must demonstrate that one of ordinary skill in the art would have been motivated to combine the teachings of those references to achieve the claimed invention with a reasonable expectation of success. It is my understanding that it is not sufficient to show that one of ordinary skill in the art *could* combine elements of multiple references. Instead, there must be a rational reason that would have prompted a POSITA to combine the elements in the way the claimed invention does; and the reason should be explained or articulated.

13. I understand a combination of references would not have been obvious if the alleged modification(s) to be made to the reference(s) are inconsistent with the stated goals of the reference(s). I understand a combination of references would not have been obvious if the modification of the reference(s) to derive what is claimed would render the reference(s) unsatisfactory or inoperable for their intended purpose. I further understand the party asserting

obviousness must explain why a POSITA would have selected components for combination in the manner claimed.

14. It is my further understanding that an invention would not have necessarily been obvious simply because all the elements of the invention may have been known separately in the prior art; there must be a reason to combine the separately known elements. Obviousness cannot be based on a hindsight combination of components selectively picked from the art using the claims as guide.

A. Level of Ordinary Skill in the Art

15. I understand that certain issues in an IPR, such as claim construction and whether a claim is invalid as obvious, are assessed from the view of a hypothetical POSITA at the time of the invention. I understand there are multiple factors relevant to determining the level of ordinary skill in the art, including: (1) the level of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems

16. I reiterate my view that based on my experience and knowledge, I believe a hypothetical POSITA with regard to the '048 Patent is someone having a bachelor's degree and two or more years of experience or a master's

degree in organic synthesis or chemical engineering, with education substituting for experience and *vice versa*.

V. THE DISCLAIMED ‘803 CLAIMS ARE NOT PATENTABLY DISTINCT FROM THE CURRENT SUBSTITUTE CLAIMS

17. I have been informed that to determine if a claim is patentably distinct one 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). I have further been informed that I need to determine “if the differences in claims ‘materially alter the question of invalidity.’” *MaxLinear*, 880 F.3d at 1377 (quoting *Ohio Willow Wood*, 735 F.3d at 1342). Accordingly, this is the standard I will use in the patentably distinct analysis.

18. It is my opinion that the differences between the disclaimed claims in the ‘803 patent and the current Substitute Claims do not materially alter the question of invalidity.

19. I have been informed that Inolex has disclaimed claims 1-7, 9-11, 24-26, 28, 29, 35, and 36 of US Pat No 10,882,803, the “Disclaimed Claims”. Paper 9, IPR2023-01439. When identifying differences, it appears, at most the differences are related to reaction temperature, calcination temperature, single-pass, and time-on-stream compared to the Substitute Claims.

20. Disclaimed Claim 6 includes “wherein the bio-alkene results from a process wherein a bio-1-alcohol is dehydrated by heating the bio-1-alcohol in a reactor with a catalyst”, Disclaimed Claim 7 narrows the reactor to a fixed bed reactor, Disclaimed Claim 9 narrows the catalyst to γ -alumina and Disclaimed Claim 11 narrows the 1-alkene regioselectivity to 95%-99%.

21. A POSITA would understand, based on the specification, that heating in the process of Disclaimed Claims 6, 9, and 11, would include the dehydration temperatures used to achieve 95%-99% bio-1-alkene regioselectivity with a γ -alumina catalyst. The ‘803 specification only describes reaction temperatures in the range of 240 °C to 360 °C to achieve 95%-99% bio-1-alkene regioselectivity with a γ -alumina catalyst. The ‘803 patent at 5:66-6:2; 15: 26-41; 27:16-18; 28:46-50; 29:8-11; 29:57-59. Accordingly, a POSITA reviewing the ‘803 patent would understand that heating would include at least a reaction temperature in the range of 240 °C to 360 °C.

22. The fixed bed reactor of the process in Disclaimed Claims 6 and 7 would include at least a single pass over the catalyst. The ‘803 patent describes a fixed bed reactor as “packed with or otherwise arranged to provide sufficient contact with a catalyst.” The ‘803 patent at 15:21-22. Further, the reactor “packed with catalyst” is preferably used in “a single pass.” The ‘803 patent at 15:26-29. Accordingly, a POSITA would understand that Disclaimed Claims 6 and 7

include at least a fixed bed reactor packed with a catalyst and used in a single pass to achieve 95%-99% regioselectivity.

23. A POSITA would understand that, based on the specification, Disclaimed Claims 6, 9, and 11, would include at least a calcium promoted γ -alumina catalyst that is calcined between 400 °C to 500 °C as that is the calcination temperatures and catalyst utilized by the specification to run a dehydration reaction which achieves 95%-99% bio-1-alkene regioselectivity with a γ -alumina catalyst. The '803 patent at 8:35-51, 9:17-23, 9:38-44; 14:45-53; 15:48-56; 17:16-35. Accordingly, a POSITA would understand that the process claimed by Disclaimed Claims 6, 9, and 11 would include at least these features.

24. It is my opinion, that a POSITA reviewing the specification of the '803 patent would understand that the embodiments described by the specification that achieve all the elements of the Disclaimed Claims include the features listed in the Substitute Claims. In other words, a POSITA, based on the specification of the '803 patent, would not understand how to achieve a dehydration reaction with 95%-99% regioselectivity to the 1-alkene without including a calcined calcium modified γ -alumina catalyst, with the reaction operated at 240 °C to 360 °C.

25. It is also my opinion that time-on-stream, single pass, calcium promotion, reaction temperature, and calcination temperature are known in the art

and, therefore, would not be patentably distinct as they do not alter if the claims are obvious over the prior art of record.

26. For example, Inolex admits that the claimed dehydration temperature range is known in the art. See e.g., RMTA at 20 (reactor temperatures of 220 °C -440 °C); Ex. 2001 at ¶45 Table (De Bruyn and Le teach reactor temperatures of 280 °C to 345 °C) Ex. 2006 at ¶42 (Wu teaches reactor temperatures of 200 °C to 500 °C); ¶48 (Chokkaram teaches reactor temperatures of 280 °C); ¶120 (Wright 451 teaches reactor temperatures of 220 °C-440 °C). The Board has found this temperature range is known in the art. Paper 7 at 11, 13; Paper 16 at 11, 12, 14, 15. Inolex also admits that this calcination temperature range was known. RMTA at 18; Ex. 2001 at ¶19 (calcination at 450 C); Ex. 2006 at ¶¶ 22, 66, 72, 76. Inolex admits that calcium modification of the γ -alumina catalyst was known. Ex. 1040 at 107:13-109:1. Finally, Inolex has admitted that Wright '451 teaches single-pass over a catalyst to achieve 95% conversion. Ex. 1040 at 107:4-12.

27. Accordingly, a POSITA would understand that the differences identified above are obvious over the Disclaimed Claims of the '803 patent and further it would be obvious to utilize the teachings of the prior art to operate the processes in line with the identified distinctions.

VI. CLAIMS 29-44 ARE INVALID UNDER 35 USC §112

28. It is my understanding that 35 USC §112(a) states “The specification shall contain a written description of the invention,…”

29. I have been informed 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). I have also been informed that “There are, however, a few broad principles that hold true across all cases. ... the specification itself that must demonstrate possession.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (internal citations omitted).

30. It is my opinion that the Patent Owner has failed to identify support in the originally filed application or current specification that demonstrates they possessed the invention as claimed in the Substitute Claims.

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”

31. It is my opinion that a POSITA would not understand that the specification of the ‘048 patent indicates possession of “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” as claimed in Substitute Claim 29.

32. I agree with Dr. Wright when he 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. Despite this being a known feature of dehydration reactions, no flow rate is claimed or disclosed in the ‘048 patent. It is my opinion that because the interrelationship between reaction temperature and flow-rate largely controls the claimed outcomes, without a disclosure of both flow-rate and temperature, it is not possible for a POSITA to understand that the inventors of the ‘048 patent had possession of 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, as recited in the Substitute Claims.

33. Furthermore, after a review of the ‘048 patent itself, a POSITA would understand that it is largely silent as to flow-rates for the reactions. For example, Examples 3, 10, and 11 merely state that flow rates are adjusted to obtain the desired conversion. Ex. 1001 at 26:55-67, 28:55-67, and 29:3-11. However, with no indication of what amount of alcohol needs to be introduced or how the amount of alcohol is introduced relative to the amount of catalyst present, a POSITA would not be able to recreate the process claimed. Based on the ‘048

specification, a POSITA is unable to determine that the inventors had possession of the claimed invention.

VII. SUBSTITUTE CLAIMS 29-44 ARE INVALID AS INDEFINITE UNDER 35 U.S.C. §112(B)

34. 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...”.

35. I understand that a claim is indefinite under 35 USC 112(b) when “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.’” *IBSA Institut Biochimique, S.A. v. Teva Pharm. U.S., Inc.*, 966 F.3d 1374, 1378 (Fed. Cir. 2020)(quoting *Nautilus* , 572 U.S. at 901).

36. It is my opinion that Inolex has chosen language that does not reasonably inform a POSITA of the scope of the invention. A POSITA would understand that 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.

37. With reference to the specification of the '048 patent, a POSITA would understand that both interpretations are supported. 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 28:55-29:25. The specification also discusses that when a single-pass reactor is used, "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, based on the specification, a POSITA would not be able to determine which of the two incompatible meanings is correct.

38. Accordingly, it is my opinion that the claims do not reasonably inform a POSITA of the scope of the invention.

VIII. CLAIMS 29-44 ARE UNPATENTABLE OVER WRIGHT '451

39. It is my understanding that "[w]here a claimed range overlaps with a range disclosed in the prior art, there is a presumption of obviousness." *Ormco Corp. v. Align Tech.*, 463 F.3d 1299, 1311 (Fed. Cir. 2006). It is my opinion that Inolex has not altered scope of the claims such that they are different from the teachings of Wright '451. I also understand that Inolex has admitted that the Substitute Claims are presumptively obvious over Wright '451. MTA at 18-19.

A. Inolex Failed to Show Unexpected Results

40. I have been informed that to rebut a prima facie case of obviousness Inolex (1) can establish the existence of unexpected properties in the range claimed or (2) can show that the art in any material respect taught away from the claimed invention.

41. I do not understand Inolex to have put forward an argument that relies on Wright ‘451 teaching away from the claims.

42. I have been informed that for Inolex to overcome the presumption of obviousness they need to show that the claimed range is critical by proving there are unexpected properties in the range claimed.

43. It is my opinion, and undisputed in this proceeding, 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; Preliminary Guidance at 11-12; MTA at 18-20; Ex. 2006 at ¶¶66-70.

44. In an attempt to overcome this presumption of obviousness Inolex makes two arguments regarding unexpected results within the claimed ranges, “higher conversion” due to reaction temperature and “better 1-octene regioselectivity” due to calcination temperature. RMTA at 20. A POSITA would

not understand either of these alleged “unexpected results” to be consistent with the record or the ‘048 patent itself.

B. The ‘048 patent does not show “higher conversion”

45. Inolex argues that Wright ‘451 teaches that conversion increases with temperature, whereas the ‘048 patent discloses that conversion decreases at higher temperatures. Specifically, Inolex states 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.

46. It is my opinion that the argument relied upon is based on a misinterpretation of an experiment in the ‘048 patent. Inolex relies on Example 11 and the results contained in Table 5. RMTA at 20. Example 11, of the ‘048 patent, has three dehydration reactions at varying temperatures between 330° C to 370° C. These runs were carried out with the feed rate adjusted to convert 98-99% of the 1-hexanol fed into the reactor (1-2% 1-hexanol unchanged). Ex. 1001 at 29:6-10; see also 29:22-25 (explaining formation of additional product). Accordingly, the ‘048 specification indicates that the Example 11 reaction was run to keep consumption 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 maintained between 1.8% and 1.6% at the indicated temperatures. So consumption at 370 °C is deliberately unchanged from 330 °C.

47. A POSITA reading this table would understand that some ether dimer is formed in the course of the dehydration, that can then go on to generate 1-hexene. The lower yield of 1-hexene at 370 degrees is likely an indication of increased amount of ether in the product mixtures. This ether is probably the “additional product” mentioned by the ‘048 patent at 29:22-25. In the absence of flow rate data, the POSITA might assume that at the higher reactor temperature, time on catalyst was shorter and so not sufficient to complete conversion of the ether to 1-hexene.

48. Inolex 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%.”). To the extent that this is the underlying basis of Inolex’s arguments, the above-described yield of hexenes resulting from the dehydration reaction is a different measurement than the consumption of the starting alcohol.

49. A POSITA would not compare the yield of hexenes in the reaction product of Example 11 with the conversion of butanol starting materials in Wright ‘451 to compare the results of a reaction.

50. It is my opinion that a POSITA would understand 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.

C. Claimed Calcination Range has Expected Results

51. Inolex argues that “a calcium-promoted γ -alumina catalyst calcined at 440 °C provides unexpectedly better 1-octene regioselectivity” RMTA at 19. Inolex also argues that “[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).

52. Inolex 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. However, a POSITA would understand that these results are 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. A POSITA would not view anything unexpected about the results relied upon by Inolex as they align with the prior art teachings.

53. Inolex appears to rely on teachings outside of the claimed range of 420 °C to 480 °C. Instead, Inolex compares the claimed results at 440 °C to its own example using a calcination temperature outside the claimed range, i.e., 500 °C. RMTA at 19. It is my opinion that a POSITA would not look to results outside

of the claimed range to determine if something within the claimed range is expected to happen.

54. Moreover, it is my opinion that the results of the single experiment in the '048 patent do not indicate to a POSITA that there is necessarily a negative impact at calcination of 500 °C because the art, as confirmed by Dr. Wright, includes examples of calcination at 500 °C and above achieving consistent results depending on the parameters of the reaction. See e.g., Ex. 2006 at ¶118 (providing examples in Wright '451 that achieve the claimed results at 500°C and greater). A POSITA would not make a blanket determination of calcination efficacy based on a single data point when there are additional sources of data that contradict that data point.

55. Inolex 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. As stated in my previous declaration, Ex. 1038 at ¶¶ 22-28, each of these references provides background used by a POSITA when considering Wright '451 and other prior art references.

56. 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 that Chokkaram's discussion of calcining at increasing

temperatures and identifying a peak surface area between 400 °C and 500 °C would show a POSITA the optimum calcination temperature range.

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

58. Chokkaram is relied on for the teachings related to optimized calcination temperature for dehydration of octanol. 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.”). A POSITA would understand both the similarities and differences contained in the prior art references and be able to use the teachings that are applicable to the process they are undertaking.

59. Similarly, Inolex 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 additionally teaches a reaction temperature of the alcohol’s boiling point. Ex. 1044 at [0028]. Takamura describes its invention as dehydrating primary alcohols to create an olefin in high

yield using a modified γ -alumina catalyst. Ex. 1044 at [0019]. A POSITA would consider these teachings as applicable to the Substitute Claims.

60. Further Takamura explains that using a γ -alumina catalyst with 1-3% metal oxide after calcining at 450 °C in a dehydration reaction of 1-octanol at 200 °C to 300 °C yields the desired olefin in excess of 95%, which notably is the process currently claimed in the Substitute Claims. Ex. 1044 at [0008], [0037], [0051]-[0055].

61. It is my opinion that a POSITA would not find any patentable distinctions between the Substitute Claims and the Disclaimed Claims. Accordingly, in my opinion, there are no unexpected results within the claimed range.

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

62. I agree with Inolex, that claims 29-44 are presumptively obvious and the only identified differences are narrower temperature ranges. RMTA at 18-20. However, because, as demonstrated above, a POSITA would not understand there to be any unexpected results within the narrower temperature ranges of Substitute Claims 29-44, they 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

63. A POSITA would understand that 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] (starting alcohols can be bio-1-alcohols.). The γ -alumina is "...modified with Ca^{+2}" Ex. 1039 at [0014] (" Ca^{+2} is the modifier and the Ca^{+2} compound is calcium acetate ($\text{Ca}(\text{OAc})_2$)"), [0066]. Wright '451 also teaches that the γ -alumina catalyst, after modification, is calcined. Ex. 1039 at [0067] (the promoted catalyst is "...typically followed by a drying or calcination process"); *see also* [0065] (additional calcium containing compounds); Ex. 1038 at ¶¶22-28, 63; Ex. 1040 at 110:3-117:11, 120:11-121:10. The calcination process takes place in a vessel "at about 100 °C to about 900 °C, or about 200 °C to 600 °C" "for a period of time of about 1h to about 8h". Ex. 1039 at [0067]. Further, the dehydration reaction takes place between 220 °C to 440 °C. Ex. 1039 at [0013], [0049], [0077]. Silanization is an affirmative step, which is not undertaken here.

64. Accordingly, a POSITA would understand that Wright '451 teaches each feature of the claim, including the temperature and calcination ranges.

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.

65. A POSITA would understand that 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. 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; *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 time on stream of "up to 48 months". Ex. 1039 at [0050]; *see also* [0015], [0075], [0076].

66. Accordingly, a POSITA would understand that 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.

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.

67. A POSITA would understand that, 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). 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.

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%.

68. A POSITA would understand that Wright '451 includes a calcium-promoted γ -alumina catalyst with a CaO content of about 1% to about 2%. Wright '451 at [0014], [0031]. [0032].[0065], [0067] (Ca^{+2} in the range of 0.8 to 2.0 wt% or about 1.0 to 1.7 wt%); see also Ex. 1039 at [0093]-[0118]. Accordingly, Wright '451 discloses 1.0 to 1.7 wt% CaO content.

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.

69. A POSITA would understand that all γ -alumina is prepared by calcination, often in the claimed temperature range. 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)). Accordingly, prior to treatment with

calcium, which is prior to dehydration, the γ -alumina has been prepared by calcination at elevated temperature.

70. A POSITA would further understand that Wright '451 discloses that the catalyst is calcined, prior to the dehydration reaction of alcohols, at temperature ranges that include 440 °C to 460 °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. As discussed above, there are no unexpected results within the claimed range.

71. Accordingly, A POSITA would understand that Wright '451 discloses prior to the dehydrating, the catalyst has been calcined at a temperature of about 440 °C to about 460 °C and the bio-alkene has a carbon chain of 6 to 8 carbon atoms. Ex. 1038 at ¶¶76, 82, 88, 95.

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.

72. A POSITA would understand that 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). The examples include reactions run at 340 °C. See e.g., Ex. 1039 at [0042]-[0045], FIGs. 9-12.

Accordingly, by the reaction operating as expected within the claimed range, Wright '451 renders the claimed reaction temperature range obvious.

IX. CLAIM 29-44 ARE OBVIOUS OVER DE BRUYN IN VIEW OF TAKAMURA

A. Motivation to Combine

73. In my opinion, a POSITA would refer to both De Bruyn and Takamura as both references address the dehydration of 1-alcohols to the 1-alkene at high conversion and regioselectivity. Ex. 1044 at [0008] and Ex 1008 at [0035]. 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 provide further details about how to implement the promoted alumina catalyst discussed by De Bruyn. 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. 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]. 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

74. A POSITA would understand that 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]. 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].

75. Accordingly, it is my opinion that POSITA would understand that De Bruyn in view of Takamura teaches 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 as presently claimed.

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.

76. A POSITA would understand that 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. 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]. 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 is able to achieve these results in a single-pass reaction after 20 hours time-on-stream, as that is a design choice based on scale. Industrial processes, like De Bruyn, optimize differently than smaller scale reactions, and a POSITA in view of the combination of De Bruyn and Takamura can alter the reaction time to achieve the desired results.

77. Accordingly, it is my opinion that De Bruyn in view of Takamura teaches the resulting bio-alkene has a carbon chain of 6 to 10 carbon atoms and is produced in a conversion of at least 95% and a bio-1-alkene regioselectivity of 95% to about 99% from a single-pass reaction after at least 20 hours time-on-stream as presently claimed.

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.

78. De Bruyn in view of Takamura teaches a dehydration reaction for 1-hexanol and 1-octanol. Ex. 1008 at [0037], [0053], [0068]-[0071], [0081]-[0083]. Accordingly, it is my opinion that a POSITA would understand that De Bruyn in view of Takamura teaches the bio-alkene having a carbon chain of 6 to 8, 6, and 8 carbon atoms

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%.

79. De Bruyn in view of Takamura teaches a calcium-promoted γ -alumina with a CaO content of about 1% to about 2%. Ex. 1008 at [0037]; Ex. 1044 at [0054]. Accordingly, it is my opinion that a POSITA would understand

that De Bruyn in view of Takamura teaches that the calcium-promoted γ -alumina has a CaO content of about 1% to about 2%, as presently claimed.

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.

80. De Bruyn in view of Takamura teaches that the γ -alumina catalyst can be prepared via a standard 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]. Accordingly, it is my opinion that a POSITA would understand that De Bruyn in view of Takamura teaches prior to the dehydrating, the calcium-promoted catalyst has been calcined at a temperature of about 440 °C to about 460 °C, as presently claimed.

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.

81. De Bruyn in view of Takamura teaches a dehydration reaction for 1-hexanol and 1-octanol taking place at 250 °C to 350 °C. Ex. 1008 at [0037], [0053], [0068]-[0071], [0081]-[0083]; Ex. 1044 at [0078]-[0079]. Accordingly, it is my opinion that a POSITA would understand that De Bruyn in view of

Takamura teaches that the reactor is heated at a temperature of 315 °C to 350 °C as presently claimed.

X. CONCLUSION

82. In my opinion, and in view of the foregoing, a POSITA would view Substitute Claims 29-44 of U.S. Patent No. 10,995,048 as obvious in light of the combinations of prior art references discussed above.

XI. OATH

83. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: July 25, 2024 By: 

Douglass F. Taber