

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARKEMA FRANCE,
Petitioner

v.

HONEYWELL INTERNATIONAL INC.,
Patent Owner

Case IPR2015-00916

Patent 8,710,282

Declaration of Robert D. Lousenberg, Ph.D.

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I, Robert D. Lousenberg, Ph.D., do hereby declare and say as follows:

I. INTRODUCTION AND SCOPE OF ENGAGEMENT

1. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

2. I have been retained by Alston & Bird LLP on behalf of Honeywell International Inc. (“Patent Owner” or “Honeywell”) to provide analysis and opinions in connection with three *inter partes* review (“IPR”) proceedings (IPR2015-00915, IPR2015-00916, and IPR2015-00917) before the United States Patent and Trademark Office (“PTO”) Patent Trial and Appeal Board (“Board”) as an expert in the field of fluorochemicals. My qualifications in this area, as well as other areas, are established below and by my *curriculum vitae*, which is attached as Exhibit 2003.

3. I have also been asked to evaluate whether one of ordinary skill in the art would have considered certain technologies and prior art to be relevant or material to determining the validity of the claims at issue.

4. I have also been asked to evaluate documents provided by the Patent Owner to determine whether the inventors constructed an embodiment or performed a process that met all of the limitations of the claimed invention of the ’282 patent and determined that the invention would work for its intended purpose.

5. I have also been asked to evaluate documents provided by the Patent Owner to determine whether the inventors adequately demonstrated possession of the invention claimed in the '282 patent.

6. I am being compensated for my time spent on the present matter. My compensation is not in any way contingent on my performance, the result of this proceeding, or any of the issues involved therein. I am also being compensated for expenses incurred as a result of activities performed as an expert.

II. BACKGROUND AND QUALIFICATIONS

7. After graduating with a Bachelor of Science in Chemistry, with Honors, from Simon Fraser University in 1991, I started my career as a research associate at Ballard Power Systems. During my time at Ballard, I was a key contributor in the synthesis and characterization of new conductive monomers based on trifluorostyrene and emulsion polymerization, resulting in partially fluorinated polymers and membranes for use in PEM fuel cell applications.

8. In 1995, I left Ballard to attend the University of Toronto where I obtained a Master's of Science in Organic Chemistry (1997) and a Ph.D. in Polymer Chemistry (2000). Near the end of my Ph.D. studies, I was awarded the Martin Walmsley Fellowship for Technological Entrepreneurship (\$100,000) to formally develop a business plan that was based on my graduate research. Around

the same time, I was offered a position at DuPont as a chemist in the Fluoroproducts business.

9. In 2000, I started at DuPont as a senior research chemist in the Fluoroproducts/Fuel Cells group. During this time, I was a vital member of the research and development team that led the synthesis and characterization of new Nafion®-like fluoropolymers with enhanced conductivity and fabrication of new composite and cross-linked membranes with improved swelling stability for PEM fuel cells. In 2003, I obtained my Six Sigma Green Belt certification.

10. In 2007, I transitioned into the Fluorochemicals R&D group at DuPont as a principal investigator. In this role, I was directly involved in the synthesis, characterization, and commercial process development of next generation non-flammable, non-ozone depleting, and low global warming potential refrigerants and specialty solvents. During this time, I spearheaded the development of new synthetic processes to intermediates for 1234yf production and invented Vertrel® HFX-110. I also designed commercial manufacturing processes for Vertrel® HFX-110, with applications in precision cleaning, heat transfer, and electronics manufacturing. As is further shown in my *curriculum vitae*, I was the inventor or co-inventor of many key patents in the field of low global warming potential refrigerants and solvents.

11. In 2015, DuPont spun-off its Performance Chemicals segment to the Chemours Company, which included the Fluorochemicals group. I have since retired from Chemours and transitioned into a role of providing technical consulting services for fluorochemical materials and methods of manufacture.

12. Currently, I am employed by a membrane company, Compact Membrane Systems (CMS) in Newport, Delaware. My work at CMS is focused on developing new gas separation membranes that are based on fluoropolymer technology.

13. On the basis of my education and the experience described above, I believe I am qualified to give the opinions set out herein.

III. INFORMATION CONSIDERED

14. The opinions expressed in this Declaration are based on my review of, the following: U.S. Patent No. 8,710,282 (“the ’282 patent”); the Petition for *Inter Partes* Review of U.S. Patent No. 8,710,282 in IPR2015-00916 (“Petition”); Exhibits 1001 – 1018; the Institution Decision in IPR2015-00915, Paper 14, October 21, 2015 (“Institution Decision”); and Mr. Haluk Kopkalli’s email dated March 26, 2008 and attachments thereto (EX2007). I also based my opinions on my professional and academic experience and knowledge in the area of fluorochemicals. I reserve the right to testify about these materials and experience.

In addition, all of the opinions I express in this Declaration have been made from the standpoint of a person of ordinary skill in the fluorochemical field, which I define herein below.

15. As I discuss below, I disagree with Dr. Manzer's conclusions that the subject matter of the claims of the '282 patent would have been obvious.

IV. LEGAL PRINCIPLES

16. It has been explained to me by counsel for the Patent Owner that, to find a claim unpatentable under 35 U.S.C. § 102, each and every element of a claim, as properly construed, must be found either explicitly or inherently in a single prior art reference, subject to the limitations imposed by § 102 in paragraphs a-g. Understanding that there are not any issues with respect to 35 U.S.C. § 102 in this *inter partes* review, I focus my attention on 35 U.S.C. § 103.

17. I further understand that a claimed invention is not patentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. I understand that a patent is valid unless the differences between the claimed invention and prior art are such that the subject matter as a whole

would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the patent pertains.

18. I have been told the following factors are used in making an obviousness determination: a) the scope and content of the prior art; b) the differences between the prior art and the claimed invention; c) the level of ordinary skill in the pertinent art; and d) any secondary considerations evidencing nonobviousness.

19. I am also aware that secondary considerations of nonobviousness include, but are not limited to: long-felt need, failure of others, copying by others, praise by others in the industry, licensing of the claimed invention, departure from accepted principles, widespread recognition by those in the art of the invention's significance, and commercial success. I understand that there must be a demonstrated nexus between the claimed invention and the secondary considerations of non-obviousness being considered.

20. I have been informed by counsel that an invention composed of several elements is not proved obvious merely by demonstrating that each of its elements was independently known or in the prior art, but that there must be an apparent reason or motivation to combine the known elements in the fashion claimed by the patents at issue.

21. Counsel has informed me that the Petition and the Institution Decision must provide a plausible rationale as to why the prior art references would have been combined to render the claims of the patent obvious. Indeed, when the prior art teaches away from combining known elements, discovery of a successful means of combining them is more likely to be nonobvious.

22. I understand that obviousness requires at least some degree of predictability. Specifically, I understand that a reason to modify or combine prior art may support an obviousness determination, provided there is a reasonable expectation of success. I further understand that whether a proposed modification or combination of the prior art has a reasonable expectation of success is determined at the time the invention was made.

23. I understand that using the claimed invention as a blueprint to piece together various elements in the prior art amounts to hindsight reasoning. This is sometimes referred to as the prohibition on the use of hindsight reasoning in an obviousness determination.

24. I am told that a generic motivation to combine known elements is insufficient to establish obviousness. I understand that a finding of obviousness necessitates an explanation as to why a person of ordinary skill in the art would have combined elements from specific references in the way the claimed invention

does. In fact, I have been informed that knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references.

25. Counsel informs me that in accordance with the foregoing, the Patent Office may inspect for obviousness by asking whether one of ordinary skill in the pertinent art, facing the wide range of needs created by developments in that field of endeavor, would have seen a benefit to altering the closest prior art by adding to or removing from it those elements that define the differences between the prior art and the claims at issue. Unless the answer to that question is shown to be affirmative by a preponderance of the evidence, the claim will be patentable.

26. With regard to claim construction, I understand that in an *inter partes* review; claim terms are given their broadest reasonable construction in light of the specification of the patent in which they appear. Institution Decision, Paper No. 14, pp. 6 - 10. I understand that under the broadest reasonable interpretation standard, claim terms are presumed to be given their ordinary and customary meaning as understood by one of ordinary skill in the art in the context of the entire disclosure at the time of the invention. I understand that one must be careful not to read a specific embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. I further understand that any special definition for a claim term must be set forth with reasonable

clarity, deliberateness, and precision. I have considered each of the claim terms using the broadest reasonable interpretation standard.

27. I am informed that “conception” refers to the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention, as it is thereafter to be applied in practice. I also understand that the idea must be definite and permanent enough that one skilled in the art could understand the invention without extensive research or experimentation. Further, the conception must encompass all limitations of the claimed invention, but the inventor need not know that his or her invention will work for conception to be complete.

28. I understand that in order to establish reduction to practice, the inventor must have (1) constructed an embodiment or performed a process that met all the claim limitations and (2) determined that the invention would work for its intended purpose. I understand that the essential inquiry is whether the advance in the art represented by the invention was embodied in a workable device that demonstrated that it could do what it claimed to be capable of doing. I further understand that for the purpose of antedating a reference, it is sufficient that the patent owner has shown a reduction to practice of his basic invention, which showing will also suffice as to claims differing therefrom only in details which are

obvious to one of ordinary skill in the art. I understand that reduction to practice does not require that the invention, when tested, be in a commercially satisfactory stage of development. I further understand that that a completed invention requires both conception and reduction to practice, there is no requirement that the inventor be the one to reduce the invention to practice so long as the reduction to practice was done on his behalf.

29. I am informed that in order to be enabling, the specification of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without “undue experimentation.” It is my understanding that the following factors provide a guide in determining what constitutes undue experimentation: 1) the quantity of experimentation necessary; 2) the amount of direction or guidance presented; 3) the presence or absence of working examples; 4) the nature of the invention; 5) the state of the prior art; 6) the relative skill of those in the art; 7) the predictability or unpredictability of the art; and 8) the breadth of the claims. It is my further understanding that these factors need not be applied rigidly in every case and not all of the factors need not favor nonenablement to find that practicing the full scope of the claimed invention requires undue experimentation.

V. SUMMARY OF OPINIONS

30. I understand that the Board has granted Arkema France's ("Petitioner") petition to institute this IPR as to claims 1-20 of the '282 patent with respect to the following ground: whether claims 1-20 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Smith, Masayuki, and Harrison.

31. Objectively viewing the art, it is my opinion that Smith, Masayuki, and Harrison fail to disclose all of the elements of claims 1-20 of the '282 patent.

32. It is my further opinion that a person of ordinary skill in the art would not have, without knowledge of the '282 patent, looked beyond Smith in order to formulate a more efficient process for manufacturing 1234yf or fluoroolefins generally.

33. While the claims may be read broader, it appears that Petitioner has limited itself to the use of KOH as the alkali metal hydroxide to be used as its proposed combination includes Smith, Masayuki, and Harrison. Harrison, which is directed to a process for the preparation of calcium fluoride (CaF_2) from industrial waste waters, only utilizes the specific alkali metal hydroxide KOH and makes no disclosure of any other alkali metal hydroxide.

34. It is my further opinion that a person of ordinary skill in the art would not look to Harrison in combination with Smith and Masayuki as Masayuki specifically teaches away from using waste waters.

35. It is also my opinion that the inventors conceived of the invention of Claims 1-20 of the '282 patent at least as early as March 26, 2008.

VI. THE '282 PATENT

A. Specification and Claims

36. I understand that Petitioner has challenged claims 1-20 of the '282 patent, EX1001, in this action.

37. I further understand that the '282 patent has a priority date of March 14, 2008. I have been informed that Petitioner has challenged Patent Owner's entitlement to this priority date and has argued that the earliest possible priority date for the claims of the '282 patent is October 12, 2010, the filing date of U.S. Provisional Application No. 61/392,242.

38. The '282 patent is directed, generally speaking, to processes for producing haloalkenes, particularly, though not exclusively, 2,3,3,3-tetrafluoropropene ("1234yf") and/or 1,2,3,3,3-pentafluoropropene ("1225ye"). (EX1001.)

39. The '282 patent has four independent claims (claims 1, 10, 21, and 36) and 42 dependent claims. (*Id.*) Independent claims 1 and 10, and the dependent claims which depend therefrom, are the subject of this IPR.

40. Generally speaking, independent claim 1 of the '282 patent is directed to a method for producing at least one fluorinated olefin comprising (a) hydrogenating a starting material stream comprising at least one alkene according to Formula (I): $(CX_nY_{3-n})(CR^1_aR^2_b)_zCX=CH_mX_{2-m}$, by contacting said starting material with a reducing agent to produce an intermediate product stream comprising at least one alkane according to Formula (II): $(CX_nY_{3-n})(CR^1_aR^2_b)_zCHXCH_{m+1}X_{2-m}$, where each X is independently Cl, F, I or Br, provided that at least two Xs are F; each Y is independently H, Cl, F, I or Br; each R1 is independently H, Cl, F, I, Br or unsubstituted or halogen substituted methyl or ethyl radical; each R2 is independently H, Cl, F, I, Br or unsubstituted or halogen substituted methyl or ethyl radical; n is 1, 2 or 3; a and b are each 0, 1 or 2, provided that a+b=2; m is 0, 1 or 2; and z is 0, 1, 2 or 3; (b) optionally, separating said intermediate product stream into a plurality of intermediate product streams, said plurality of intermediate product streams comprising two or more streams selected from the group consisting of a first stream rich in at least a first alkane according to Formula II, a second stream rich in at least a second alkane

according to Formula II, and an alkane recycle stream; (c) dehydrofluorinating, in the presence of a dehydrohalogenating agent, at least a portion of said intermediate process stream from step (a) or said plurality of intermediate process streams of step (b) to produce an alkene product stream comprising 1,1,1,2,3-pentafluoropropene and at least one additional alkene having a lower degree of fluorine substitution compared to the degree of fluorination of the compound of formula (I); and (d) withdrawing from a dehydrofluorinated product stream a product reaction stream comprising spent dehydrohalogenating agent; and (e) recovering spent dehydrohalogenating agent. (EX1001 at 16:29-17:4.)

41. Generally speaking, dependent claim 2 of the '282 patent is directed to the method of claim 1, wherein the additional alkene is a compound according to the formula (I): $(CX_nY_{3-n})(CR^1_aR^2_b)_zCX=CH_{m+1}X_{1-m}$, where each of X, Y, R^1 , R^2 , n, a, and b is the same value as in formula (I) and m is 0 or 1. (EX1001 at 17:5-10.)

42. Generally speaking, dependent claim 3 of the '282 patent is directed to the method of claim 2, wherein the Z is 0. (EX1001 at 17:11.)

43. Generally speaking, dependent claim 4 of the '282 patent is directed to the method of claim 3, wherein m is 0 or 1. (EX1001 at 17:12.)

44. Generally speaking, dependent claim 5 of the '282 patent is directed to the method of claim 4, wherein n is 3. (EX1001 at 17:13.)

45. Generally speaking, dependent claim 6 of the '282 patent is directed to the method of claim 5, wherein X is F. (EX1001 at 17:14.)

46. Generally speaking, dependent claim 7 of the '282 patent is directed to the method of claim 1, wherein the reducing agent is H₂. (EX1001 at 17:15-16.)

47. Generally speaking, dependent claim 8 of the '282 patent is directed to the method of claim 1, wherein the starting material stream comprises hexafluoropropylene ("HFP") and the additional alkene is 2,3,3,3-tetrafluoropropylene (1234yf). (EX1001 at 17:17-19.)

48. Generally speaking, dependent claim 9 of the '282 patent is directed to the method of claim 1, wherein the dehydrohalogenating agent is selected from the group consisting of KOH, NaOH, Ca(OH)₂, LiOH, Mg(OH)₂, CaO, and combinations thereof. (EX1001 at 17:20-22.)

49. Generally speaking, independent claim 10 of the '282 patent is directed to a method for producing 2,3,3,3-tetrafluoropropene (1234yf) comprising (a) hydrogenating a starting material stream comprising HFP by contacting the starting material stream with a reducing agent in a hydrogenation reactor to produce an intermediate stream comprising 1,1,1,2,3-pentafluoropropane (245eb)

or 1,1,1,2,3,3-hexafluoropropane (236ea); (b) dehydrofluorinating, in the presence of a dehydrohalogenating agent, the 245eb or 236ea in a dehydrofluorination reactor to produce a product stream comprising 1234yf or 1,2,3,3,3-pentafluoropropene (1225ye); (c) withdrawing from the product stream a second product stream comprising spent dehydrohalogenating agent; and (d) recovering spent dehydrohalogenating agent. (EX1001 at 17:23-40.)

50. Generally speaking, dependent claim 11 of the '282 patent is directed to the method of claim 10, wherein the second product stream further comprises one or more dissolved organics. (EX1001 at 17:41-42.)

51. Generally speaking, dependent claim 12 of the '282 patent is directed to the method of claim 11, wherein the dissolved organics are selected from the group consisting of 236ea, 245eb, and combinations thereof. (EX1001 at 17:43-46.)

52. Generally speaking, dependent claim 13 of the '282 patent is directed to the method of claim 10, wherein the spent dehydrohalogenating agent is purified using at least one separation method. (EX1001 at 17:47-49.)

53. Generally speaking, dependent claim 14 of the '282 patent is directed to the method of claim 13, wherein the separation method is selected from the group consisting of distillation and phase separation. (EX1001 at 17:50-52.)

54. Generally speaking, dependent claim 15 of the '282 patent is directed to the method of claim 10, further comprising, optionally, concentrating the purified dehydrohalogenating agent and recycling it back to the dehydrohalogenation reaction. (EX1001 at 17:53-55.)

55. Generally speaking, dependent claim 16 of the '282 patent is directed to the method of claim 10, wherein the reaction stream further comprises by-product salts of the dehydrohalogenating agent. (EX1001 at 17:56-58.)

56. Generally speaking, dependent claim 17 of the '282 patent is directed to the method of claim 16, further comprising converting the by-product salts to the dehydrohalogenating agent. (EX1001 at 17:59-60.)

57. Generally speaking, dependent claim 18 of the '282 patent is directed to the method of claim 16, wherein the dehydrohalogenating agent is KOH and the by-product salt is KF. (EX1001 at 17:61-62.)

58. Generally speaking, dependent claim 19 of the '282 patent is directed to the method of claim 18, further comprising, optionally, concentrating the converted KOH and recycling it back to the dehydrohalogenation reaction. (EX1001 at 17:63-65.)

59. Generally speaking, dependent claim 20 of the '282 patent is directed to the method of claim 18, further comprising converting KF to KOH in the presence of Ca(OH)_2 . (EX1001 at 17:66-67.)

B. Person of Ordinary Skill in the Art

60. A person of ordinary skill in the art of the '282 patent would have education and/or experience in the fields of chemistry or chemical engineering and would have taken courses in organic chemistry. Such a person would, based on course work, have a general understanding of organic chemistry and expertise in the techniques used for separating chemicals based on their physical properties. Moreover, the education and experience levels may vary between persons of ordinary skill in the art, with some persons holding a bachelor's degree, but with at least 5 years of relevant work experience, or others holding a more advanced degree, such as a Ph.D. or M.S., but having fewer years (i.e., 2-3 years) of experience.

C. Claim Construction

61. A person of ordinary skill in the art would understand the terms below as follows:

Claim Term	Construction
"spent DHA"	"an aqueous solution containing DHA"

	and by-product salts”
“recovering spent DHA”	“substantially separating spent DHA from any other materials in the [product reaction stream (Claim 1)/second product stream (Claim 10)”
“purifying” or “purified”	“further separating recovered spent DHA from all other materials in the [product reaction stream (Claim 1)/second product stream (Claim 10)”
“recycling”	“returning a component of the reaction back to the reaction”
“dehydrofluorinated product stream” or “product stream”	“a continuous flow of a fluid consisting of at least the olefin products resulting from a dehydrofluorination reaction”
“product reaction stream”, “second product stream”, or “reaction stream”	“a continuous flow of a fluid consisting of at least spent DHA resulting from a dehydrofluorination reaction”
“dissolved organics”	“unreacted organic materials entrained in an aqueous solution”

1. “Spent DHA”

62. The person of ordinary skill in the art would understand “spent” refers to DHA that has gone through the process of the claimed invention of the ’282 patent. In other words, the person of ordinary skill in the art would understand “spent” to mean used or non-pure, such as a material that has a lower concentration than virgin material. For example, “[s]pent dehydrohalogenating agent and by-product salts (e.g. metal fluoride salts) may be withdrawn from the reactor by a product stream either continuously or intermittently using one or more known separation techniques.” (EX1001 at 13:16.)

63. While the above referenced section may be read to indicate that the DHA can be withdrawn separately from the by-product salts, the person of ordinary skill in the art would understand that the aqueous solution would necessarily comprise a mix of the DHA and by-product salts. For example, in the aqueous solution, there are alkali metal cations, fluoride anions, and hydroxide anions. In such a case, alkali metal cations are not associated with any one species of anion.

64. “Spent DHA” must then be interpreted to cover both DHA and by-product salts (i.e., KF) that would be present in the aqueous phase of a reaction, such as the reaction outlined in the ’282 patent. The specification clarifies this

understanding at least in column 13, line 4, for example: “In certain embodiments, spent dehydrohalogenating agent is removed from the product stream either periodically or continuously and is recycled back to the reactor for reuse.” (*Id.*)

65. Any construction of the term “spent DHA” that does not contemplate all of the materials in the aqueous or liquid phase that are capable of being withdrawn from the reactor would be non-sensical, because the DHA or KOH and by-product salts would exist as an aqueous mixture of alkali metal cations, fluoride anions, and hydroxide anions and would be inseparable at this point. Accordingly, it is my opinion that the broadest reasonable construction of “spent DHA” is: “an aqueous solution containing DHA and by-product salts.”

2. “Recovering spent DHA”

66. In reviewing the claim terms, I understand that the terms “withdrawing” and “recovering” must not become conflated. Accordingly, it is my view that the person of ordinary skill in the art would understand that “recovering” is something more than mere withdrawal, and necessarily occurs after the “spent DHA” is withdrawn.

67. The term “recovering” is used as a physical process that does not include a chemical reaction in the art. This is unlike a term such as “regenerating,” which signifies a chemical process. Consistently, when discussing the concept of

“recovering spent DHA,” the ’282 patent does so in the context of separating organics, and any unidentified heavies, dissolved in the aqueous reaction mixture from the previously withdrawn spent DHA (*see e.g.*, ’282 Patent at 13:29-45; 15:44-49; 16:14-23). In one particular example, the ’282 patent describes “recovering” in terms of a Scrubber Product Collection Cylinder (SPCC), where the SPCC is configured to trap the dissolved organics so as to separate the dissolved organics from the spent DHA. (’282 patent, 15:43-47) (“Scrubber Product Collection Cylinder (SPCC) was used to collect spent KOH and the portion of organic that was carried out with spent KOH. Organic was trapped in methylene chloride which was previously added to SPCC”).

68. It is my opinion that a person of ordinary skill in the art would have understood that the recovering step removes dissolved organics from the aqueous reaction mixture so as to result in substantially organic free DHA isolate (*see e.g.*, ’282 Patent at 16:22-23 (“GC analysis revealed that the amount of organic was negligible.”). Understanding that the term “dissolved organics” is used in a dependent claim, I cannot understand a situation in which there would not be dissolved organics in a product or reaction stream.

69. I, however, understand that the Institution Decision issued in this proceeding did not consider the dissolved organics as a necessary part of the

stream. I disagree for the reasons stated above and would include the separation from dissolved organics in my construction of the term “recovering.” That said, it is my opinion that the claims must be read at the very least to include a separation from the other elements in stream. Accordingly, and in view of the Institution Decision by the Board, “recovering spent DHA” means “substantially separating spent DHA from any other materials in the [product reaction stream (Claim 1)/second product stream (Claim 10)].”

3. “Purifying” or “Purified”

70. In reviewing the claim terms, I understand that the terms “recovering” and “purifying”/“purified” must not become conflated. Accordingly, it is my view that the person of ordinary skill in the art would understand that “purifying”/“purified” is something more than recovering, and necessarily occurs after the “spent DHA” has been recovered.

71. When discussing the concept of “purifying” spent dehydrohalogenating agent, the ’282 patent indicates that it is separate and distinct from recovering and regenerating. (EX1001 at 3:15-17 (“recovering, purifying and/or regenerating.”))

72. A person of ordinary skill in the art would understand “purifying”/“purified” to require something more than mere separating.

73. “Purifying”/“purified” means “further separating recovered spent DHA from all other materials in the [product reaction stream (Claim 1)/second product stream (Claim 10)].”

4. “Recycling”

74. The person of ordinary skill in the art would understand that in recycling a component of the reaction back to the reactor it would be beneficial to do so in the same form or substantially the same form (i.e., concentration). That said, the ’282 patent is not so limited and allows for an immediate recycling of “spent DHA.” Such a reading is consistent with the ’282 patent. For example: “[t]he organic free KOH isolate can be immediately recycled to the reactor or can be concentrated and the concentrated solution can be returned to reactor.” (EX1001 at 13:43-45.)

75. Accordingly, the person of ordinary skill in the art would understand that the broadest reasonable interpretation of “recycling” in view of the specification as “returning a component of the reaction back to the reaction.”

**5. “Dehydrofluorinated product stream,” “product stream,”
“product reaction stream,” “second product stream”, or “reaction
stream”**

76. “Stream” is used throughout the ’282 patent and is used to describe various inputs and outputs of the reaction system. A person of ordinary skill in the art would understand that a stream implies a measure of volume per unit time.

77. Understanding the definition of the term “stream,” the person of ordinary skill in the art would interpret the contents of a claimed stream based on the reaction steps involved in the various claims in which the stream is recited.

78. Accordingly, the person of ordinary skill in the art would understand that the broadest reasonable interpretation of “dehydrofluorinated product stream” or “product stream” in view of the specification as “a continuous flow of a fluid consisting of at least the olefin products resulting from a dehydrofluorination reaction” and “product reaction stream,” “second product stream,” or “reaction stream” in view of the specification as “a continuous flow of a fluid consisting of at least spent DHA resulting from a dehydrofluorination reaction.”

6. “Dissolved organics”

79. The ’282 patent describes “dissolved organics” by way of examples. Specifically, entrained 236ea or 245eb. For example, the ’282 patent recites: “[t]he

product stream containing spent dehydrohalogenating agent typically carries with it some dissolved organic (e.g. HFC-236ea and/or HFC-245eb).” ’282 patent, 13:29-31.

80. “In certain embodiments, the stream of spent dehydrohalogenating agent further includes one or more dissolved organics, such as, but not limited to HFC-236ea and/ or HFC-245eb.” ’282 patent, 5:20-22. While “dissolved organics” would include 236ea and 245eb when 236ea and 245eb are the haloalkanes used in the dehydrohalogenation reaction, other haloalkanes are encompassed by the ’282 patent and would be found as “dissolved organics” in the stream of spent dehydrohalogenating agent when used as the organic feeds in the claimed invention.

81. The person of ordinary skill in the art would recognize that the aqueous solubilities of organics such as 236ea and 245eb are low. High sheer mixing is required to form very small droplets of organic and aqueous phase with a high surface area to volume in order to facilitate the dehydrofluorination reaction. The separation of the droplets is time dependent and a fraction of organic remains entrained in the aqueous phase and vice versa, long after mixing has stopped. Accordingly, the person of ordinary skill in the art would understand that the

broadest reasonable interpretation of “dissolved organics” in view of the specification as “unreacted organic materials entrained in an aqueous phase.”

VII. THE CLAIMS OF THE '282 PATENT ARE NOT OBVIOUS

82. Below I address the references as asserted in the Petition and as considered by the Institution Decision. As will be illustrated below, each of these references describe methods that are fundamentally different from the claimed methods of producing fluoroolefins in the '282 patent.

A. Smith does not disclose certain elements of the claims

1. Smith does not disclose “spent DHA”

83. Smith is allegedly directed to the process for the preparation of 1234yf which includes (a) contacting HFP with hydrogen in the presence of a hydrogenation catalyst to produce 236ea; (b) dehydrofluorinating 236ea to produce 1225ye; (c) contacting 1225ye with hydrogen in the presence of a hydrogenation catalyst to produce 245eb; and (d) dehydrofluorinating 245eb to produce 1234yf.

84. Although Smith appears to be directed to preferred methods of vapor phase dehydrofluorination (see Examples 2 and 3; Exhibit 1003 at 19-21), Smith indicates that “another preferred method of effecting the dehydrofluorination in steps (b) and (d) is by contacting 236ea and/or 245eb with a base (base mediated dehydrofluorination).” Ex. 1003 at 11. The base mediated dehydrofluorination is

not the focus of Smith's disclosure or examples, accordingly, this disclosure is short on details.

85. Although Smith focuses on the product of the reaction (i.e., 1234yf) and does not discuss the reaction by-products, a person of ordinary skill in the art would understand that an alkali halide salt (e.g., KF) would be present as a reaction by-product of the base mediated dehydrofluorination steps purportedly disclosed in Smith.

86. However, Smith does not disclose the existence of or any appreciable amount of spent DHA. Not only does Smith not disclose spent DHA, my review of Smith reveals that the disclosed process does not even contemplate the existence of a significant aqueous phase output from the dehydrofluorination reaction steps.

87. Smith discusses methods of increasing the efficiency of the reaction steps for producing 1234yf. For example, Smith states that "[t]he base-mediated dehydrofluorination of steps (b) and (d) is preferably conducted in the presence of a catalyst. The catalyst is preferably a phase transfer catalyst which facilitates the transfer of ionic compounds into an organic phase from, for example, a water phase." Ex. 1003 at p. 14. Moreover, "[a]n effective amount of the phase transfer catalyst should be used in order to effect the desired reaction, influence selectivity to the desired products or enhance the yield...." Ex. 1003 at p. 14.

88. Thus, I understand Smith intended to create an efficient process, however, Smith is silent with respect to the existence of, let alone, any appreciable amount of, spent DHA that would need to be recovered or recycled as part of an efficient process. As such, there is no motivation for a person of ordinary skill in the art to make Smith more efficient without looking to the '282 patent as a guide.

2. Smith does not disclose “recovering spent DHA”

89. At least inasmuch as Smith is completely silent as to the existence of, let alone, any appreciable amount of spent DHA, my review of Smith reveals that Smith fails to disclose “recovering spent DHA.”

B. Masayuki does not disclose certain elements of the claims

1. Masayuki does not disclose “recovering spent DHA”

90. It is my understanding that Masayuki sought to produce chloroprene in a long term continuous process which, among other things, did not readily result in clogging of the apparatus due to the chloroprene polymer. Ex. 1005 at 6:5-13. Masayuki recognized that the “salt water” produced in such a process “contains primarily unreacted alkali metal hydroxide and produced alkali metal chloride as well as a small amount of organic components.” Ex. 1005 at 4:35-38 (Emphasis added). These organic components, which are entrained in the salt water/aqueous phase, are what Masayuki realized caused clogging problems in the process:

“[C]onventionally precipitation of dissolved alkali metal chloride accompanying the evaporation of this water as well as precipitation of polymer due to small amounts of 3,4-dichloro-butene-1, chloroprene and polymer contained in the aqueous phase are problematic. Though it is possible to dissolve precipitants using water, as is typically done to avoid trouble arising from the precipitation of alkali metal chloride, trouble caused by polymer requires that the apparatus used be dismantled. As a result, concentration of alkali metal hydroxide aqueous solution containing polymerizable organics, as is performed in the present invention, has not been previously carried out.”

(Ex. 1005 at 9:15-27) (Emphasis added).

91. Rather than separating the small amounts of 3,4-dichloro-butene-1 and chloroprene entrained in the aqueous phase from the alkali metal hydroxide, Masayuki's proposed solution to the clogging problem is to perform the concentration step at a high temperature (i.e., 95-150°C) in order to prevent problems caused by polymerization:

As a result of intensive investigations, it was discovered that when the operation is performed at a temperature of 95°C or greater, it is possible to avoid trouble caused by polymer, even when a standard

apparatus is used. If concentration is performed at a temperature lower than 95°C, within a short period of time, disassembly of the apparatus is required due to deposition of polymer onto the apparatus. Additionally, operation at a temperature of 150°C or greater is not energy efficient and requires that expensive materials be used for the apparatus, which is not desirable. Therefore, concentration performed within a range of 95 – 150°C is suitable.

(Ex. 1005 at 9:27-10:2).

92. Thus, although Masayuki recognizes the presence and problems associated with organic components entrained in the aqueous phase, Masayuki does not solve this problem by separating the entrained organics. Rather, Masayuki teaches that if the temperature is kept high during the concentration of the alkali metal hydroxide solution, “it is possible to avoid trouble caused by [the entrained organics].”

93. That is, while concentration was performed at a high temperature, “steam discharged from Enricher 21 was directed into Condenser 23 via Conduit 7, condensed and removed via Conduit 32 as water.” (Ex. 1005 at 11:21-23).

94. The proposed invention taught by Masayuki is to retain the organics and to use temperature to mitigate the effect the entrained organics have on further

processing. As such, Masayuki allegedly solves the problem by accommodating the existence of the entrained organics.

95. As such, Masayuki does not disclose at least the “recovering spent DHA” limitation required by Claims 1 and 10, and claims depending therefrom.

96. Petitioner relies on Masayuki’s disclosure of decanting, concentrating precipitating, and separating of alkali metal chloride precipitate as teaching “recovering spent KOH.” Each of these steps, however, fails to separate the dissolved organic components from the aqueous phase in order to recover spent DHA. Specifically, with respect to the decanting step, Petitioner relies on the following passage in Masayuki:

The aqueous phase was extracted via Conduit 4 such that the level of Reactor 19 remained constant and the lightly mixed lipid and aqueous phases (including precipitated sodium chloride) were separated using Decanter 20, after which the lipid phase was returned to the reactor via Conduit 5.

(Ex. 1005 at 10:33-11:1).

97. It is my opinion that the decanting step in Masayuki is utilized to separate the organic catalyst contained in the lipid phase from the aqueous phase. Once removed, the organic catalyst (e.g., a quaternary ammonium compound,

quaternary phosphonium compound, quaternary sulfonium compound or mixture thereof) is returned back to the Reactor 19 (Ex. 1005 at 7:21-30 and 10:33-11:1).

98. This decanting step, however, does not completely remove the organic components—small amounts of 3,4-dichloro-butene-1, chloroprene and polymer—which are entrained in the aqueous phase as these organic components remain entrained in the aqueous phase as it progresses to the concentration loop consisting of the enricher and heat exchanger. Ex. 1005 at 9:24-27 and 11:1-9.

99. It is my opinion that the primary function of the decanter in Masayuki is to separate the organic catalyst. It is not Masayuki's intention to further separate the 3,4-dichloro-1-butene and chloroprene from the aqueous phase in the decanter.

100. With respect to the concentrating step, Petitioner relies on the following passage in Masayuki:

The aqueous phase...was fed into a forced circulation-type Enricher 21 via Conduit 6 and concentration was carried out ... After passing through Conduit 9 from Conduit 8, the aqueous phase was heated in Heat Exchanger 22 after which it was circulating in Enricher 21 via Conduit 10.

Ex. 1005 at 11:1-9.

101. As previously explained, in order to avoid clogging and the resulting dismantling of the apparatus due to polymerization of the 3,4-dichloro-1-butene and chloroprene components in the aqueous phase, Masayuki teaches performing the concentration step at 95-150°C (Ex. 1005 at 9:15-10:2). Thus, Masayuki suggests that 3,4-dichloro-1-butene, chloroprene components, and polymer would be present during concentration and would not be removed by Decanter 20 or later removed via Conduit 32.

102. In addition, after concentration and upon entry into the slurry tank and centrifuge, Masayuki is again silent as to the removal of the 3,4-dichloro-1-butene, chloroprene components, and polymer during precipitation and separation of the solid alkali metal chloride indicating that the 3,4-dichloro-1-butene, chloroprene components, and polymer are still present. Ex. 1005 at 11:9-16. Thus, Masayuki fails to teach the separation of the polymerizable 3,4-dichloro-1-butene, chloroprene components, and polymer from the aqueous phase from any step in its process.

103. Therefore, although Masayuki recognizes the presence of and the problems associated with the 3,4-dichloro-1-butene, chloroprene components, and polymer in the aqueous phase, Masayuki does not teach a person of ordinary skill in the art to separate such 3,4-dichloro-1-butene, chloroprene components, and

polymer. Rather, Masayuki directs a person of ordinary skill in the art to carry out the concentration of the alkali metal hydroxide solution in the presence of the polymerizable organics. As such, Masayuki fails to disclose at least the “recovering spent DHA” limitation required by Claims 1 and 10, and all claims depending therefrom.

C. Harrison does not disclose certain elements of the claims

1. Harrison does not disclose “recovering spent DHA”

104. Harrison is directed to a process for the preparation of calcium fluoride from industrial waste waters which comprises, among other steps, treatment of the waste waters with potassium hydroxide followed by lime precipitation (Ex. 1006 at Abstract).

105. A review of Harrison reveals that it is completely silent as the substantial separation of spent KOH from any other materials in the aqueous reaction mixture. The only separation disclosed by Harrison that I can identify is the separation of calcium fluoride from converted KOH in *after* regeneration of the KOH with lime. (EX1006 at 2:14-21 and 3:6-10.) This separation however cannot be “recovering spent DHA” as the calcium fluoride would not be separating “spent DHA” from everything else in the reaction stream. As construed, “recovering” deals with “spent DHA,” while the separation of the calcium fluoride in Harrison

would necessarily occur after the KF is gone as it has been converted to KOH. At the point in the Harrison system when calcium fluoride would be separated, there would no longer be any by-product salts in the reaction stream. That is, “spent DHA” necessarily consists of “an aqueous solution containing DHA and by-product salts” and because there are no by-product salts present, there would no longer be any “spent DHA” as that term is defined above. As such, Harrison fails to disclose “recovering spent KOH.”

106. As such, the combination of Smith, Masayuki, and Harrison fails to disclose at least the “recovering spent DHA” limitations required by Claims 1 and 10 and all claims depending therefrom.

D. Smith, Masayuki, and Harrison do not teach or suggest “recovering spent DHA” from a second product stream that “further comprises one or more dissolved organics”

107. Claim 11 suggests that the second product stream comprises “dissolved organics.”

108. As described *supra*, Smith, Masayuki, and Harrison fail to teach or suggest “recovering.”

109. Further, Harrison is completely silent as to the presence of dissolved organics and teaches nothing regarding the separating of dissolved organics from

the spent DHA in order to recover spent DHA.

110. As with Harrison, Smith is completely silent as to the separation of dissolved organics from the spent DHA in order to recover spent DHA.

111. Given that none of the cited references disclose “recovering spent DHA” from a stream that comprises dissolved organics, it logically follows that the combination of references cannot disclose, teach or suggest such a recitation. As such, when the claims are properly construed, Smith, Masayuki, and Sedat fail to render obvious at least Claim 11.

E. The Teachings of Smith, Masayuki, and Harrison Would Not Have Been Combined With Any Reasonable Expectation of Arriving at the Claimed Subject Matter of the '282 Patent

1. A Person of Ordinary Skill in the Art Would Have Had No Motivation to Look Beyond Smith to Make its Disclosed Process More Efficient

112. Petitioner asserts that claims 1-21 of the '282 patent are obvious over Smith in view of Masayuki and Harrison. (Petition at p. 25.)

113. Petitioner argues that “[t]o achieve a more efficient and cost effective process than the one disclosed in Smith, a POSITA would look to analogous, base-mediated dehydrohalogenation processes for suggestions of how to recover and/or

recycle unreacted KOH and by-product salt(s) of the KOH (e.g., KF) formed in the reaction. (Petition at p. 26, citing EX1002 at ¶ 102). Petitioner further argues that “it is a ‘rule of thumb’ in chemical process design to try to recover and re-use as much valuable material as possible in a process” (Petition at p. 32). This is a narrow and incorrect assertion. Instead, the rule of thumb that I follow requires that you extract as much value out of the process, based on economics. In practice, this can mean much more or something entirely different than recovery and recycle. Instead, in my experience, the overall project and process economics need to be considered. Indeed, capital investment, fixed and variable costs, need to be evaluated in order to decide whether it necessary or practical to recover or recycle products of a reaction. It may be more economical to dispose or even sell materials to maximize value, instead of recovering or recycling.

114. Petitioner further argues that “[a] POSITA would be motivated to apply the steps of *Masayuki* to the dehydrohalogenation process described in *Smith* to recover and recycle the unreacted alkali metal hydroxide (KOH) that remains after the dehydrohalogenation reaction and would have a reasonable expectation of success in doing so.” (Petition at p. 23, citing EX1002 at ¶ 102).

115. I disagree. As discussed previously, although Smith discusses methods for producing 1234yf and appears to have intended to increase the

efficiency of the reaction steps for producing 1234yf, Smith does not disclose or ever allude to the presence of any appreciable amount of spent DHA that would need to be recovered or recycled as part of an efficient process. Indeed, there is nothing in Smith to suggest there would be any remaining DHA after the completion of the reaction. Thus, there would be no motivation leading a person of ordinary skill in the art to conclude that more efficiency would be needed in the process disclosed by Smith.

116. Properly and objectively viewed, a person of ordinary skill in the art would not have, without knowledge of the '282 patent, looked beyond Smith in order to formulate a more efficient process for manufacturing 1234yf or fluoroolefins generally.

**2. A Person of Ordinary Skill in the Art Would Not Have Combined
Smith's Teachings With Those of Masayuki and Harrison**

**i) Utilizing KOH as the Dehydrohalogenating Agent Would
Render Masayuki Inoperable Due to the Concentration
Loop**

117. Even if Petitioner's reliance on efficiency as a reason to look beyond Smith were proper, which it is not, the art upon which Petitioner relies teaches away from the use of KOH as a dehydrohalogenating agent.

118. Each of claims 1 and 10 of the '282 patent is generally directed to a method for producing at least one fluorinated olefin comprising the steps of hydrogenating a starting material, dehydrofluorinating in the presence of a DHA, withdrawing a product reaction stream or a second product stream comprising spent DHA, and recovering spent DHA. Claims 2-9 and 11-20 depend directly or indirectly from claims 1 and 10.

119. While each of claims 1 and 10 of the '282 patent may be read broader, it appears that Petitioner has limited itself to the use of KOH as the alkali metal hydroxide DHA to be used as its proposed combination includes Smith, Masayuki, and Harrison. Harrison, which is directed to a process for the preparation of calcium fluoride (CaF_2) from industrial waste waters, only utilizes the specific alkali metal hydroxide KOH and makes no disclosure of any other alkali metal hydroxides.

120. In evaluating the combination of Smith, Masayuki, and Harrison, I rely on each of their explicit teachings to explain that the addition of the slaked lime from Harrison to the slurry tank of Masayuki, would render the process inoperable for its purpose as the reaction would be unstable and would result in failure of the process.

121. In performing my analysis, I relied on KOH concentrations that ranged from 5% - 55%. EX1003, page 12; EX1005, page 7. Even though this wide range is disclosed, the person of ordinary skill in the art would understand that the higher the concentration of KOH or alkali metal hydroxide, the faster the reaction will occur and the greater conversion to products, resulting in a more economic process. Irrespective, the person of ordinary skill in the art would have understood that no matter the level of concentration, for an economic process to result and generate sufficient desired product, it is highly desirable to have at least 50% KOH utilization. Said differently, the product streams should be at least comparable in size and preferably larger than the recycle streams. At least 50% of the starting KOH would be converted to KF.

122. Masayuki teaches the concentration of the alkali metal hydroxide back to the starting concentration of alkali metal hydroxide for the purpose of further precipitating out the alkali chloride. Ex. 1005 at 10:25-26 (disclosing a starting concentration of “50% by weight sodium hydroxide aqueous solution derived from Conduit 2”) and 11:5 (“concentration was carried out such that $\text{NaOH}/(\text{NaOH} + \text{cH}_2\text{O}) = 0.5$ at 112°C and 200 mmHg (abs)”). Given that the starting concentration of NaOH is also 50%, it is a reasonable assumption that the enricher 21 is

configured to concentrate the aqueous phase containing the NaOH to the starting concentration. EX1007, pages 11-12.

123. As an initial matter, the combination of Smith, Masayuki, and Harrison with KOH as the dehydrohalogenating agent fails because the solubility of KOH and KF are similar at temperatures above 40°C. If KOH is utilized in the concentration step of Masayuki rather than the NaOH set forth in the example, the process will be unstable because one would not be able to selectively remove the KF from the KOH due to their similar solubility. Accordingly, the KF would remain in the aqueous phase. Assuming 50% utilization, the amounts of KOH and KF in the aqueous phase would be approximately the same.

124. Indeed, if the enricher 21 performs as Masayuki teaches, which there is no assertion by the Petitioner or its expert that it does not, then concentrating an aqueous phase to 50% KOH would result in that same phase having 50% KF. It therefore would become a solid. That is, by following the explicit teachings of Masayuki and concentrating to 50% KOH, there would be insufficient water to keep the KOH and KF in solution and there would be a mixture comprising KF and KOH precipitate. No further operations, include the addition of solid slaked lime in the slurry tank, as suggested by Petitioner, would occur. Accordingly, the combination would be inoperable.

125. Understanding that a concentration of KOH lower than 50% KOH can be used, it is my opinion that even at lower concentrations and assuming reasonable economic utilization rates (i.e., at least 50%) the process still is unstable and becomes inoperable. That is, the concentration of starting KOH would continue to exponentially rise after each recycle iteration until the process resulted in an inoperable concentration.

126. For example, if one were to use a starting concentration of 15% KOH into the Reactor 19 with steady state continuous operation (volume flow rate constant) as taught by Masayuki, the output KOH concentration from the reactor would be some percentage less due to utilization. Assuming the utilization of KOH is 50% in the Reactor 19, as mentioned above, Masayuki teaches concentrating the spent KOH solution back to the starting concentration, and would also result in an increased concentration of KF in solution, i.e., both at 15%. The volume of the spent KOH solution at this point is one-half of the input volume of KOH going into the reactor due to the removal of water during the concentration step.

127. Petitioner relies on Harrison at this point for its disclosure of adding lime ($\text{Ca}(\text{OH})_2$) to this slurry in order to regenerate KOH from the KF in solution, resulting in 30% KOH. Masayuki further teaches recycling the concentrated KOH

solution back to the front of the process by increasing (i.e., doubling) the volume to keep the flowrate constant with fresh 15% KOH going into the reactor. Thus, after one recycle iteration, the concentration of KOH entering into the Reactor 19 has increased to 20% KOH. The KOH utilization would increase as the concentration increases and each recycle iteration would further increase the concentration of the KOH entering into the Reactor 19, until the process becomes inoperable.

128. I would anticipate similar results for all starting KOH concentrations and increasing utilization rates as the recycle iterations would increase the starting concentration until the process becomes inoperable.

129. Thus, Petitioner's reliance on Masayuki is the fundamental flaw as it is being used to apply to multiple alkali metal hydroxides, when in actuality, Masayuki only purportedly provides an operable process with regards to sodium hydroxide (NaOH). Indeed, as shown above, Masayuki fails when used with potassium hydroxide (KOH), as proposed by Petitioner in its combination of Smith, Masayuki, and Harrison.

130. Accordingly, the art of record specifically relating to KOH teaches an inoperable process when combined as asserted by Petitioner.

**ii) The Addition of Harrison to the Concentrated KOH
Solution of Masayuki Would Render Masayuki Inoperable**

131. Petitioner's reliance on Harrison is also flawed as the combination of Smith, Masayuki, and Harrison would be inoperable due to the concentration loop set forth in Masayuki.

132. Harrison is directed to a process for the preparation of calcium fluoride (CaF_2) from industrial waste waters which comprises, among other steps, treatment of the waste waters with potassium hydroxide followed by lime precipitation. Ex. 1006 at Abstract.

133. The person of ordinary skill in the art reading Harrison would understand that the concentrations of both potassium hydroxide and potassium fluoride must be significantly low for the recited reaction to occur. For example, Harrison recites "[t]his aqueous solution contains about 15 to 20 weight percent potassium fluoride and 3 to 5 percent unreacted potassium hydroxide." (EX1006 at 3:3-5.) While such ranges are recited, the examples of Harrison illustrate less than 5 "weight percent fluoride combined as potassium fluoride." (EX1006 at 4:20-5:46.) Even in these instances, Harrison itself illustrates that even at such low percentages of potassium fluoride, a mud is created, thus, requiring significant amounts of water. (*Id.*)

134. For example, if one were to start with 50% KOH as suggested by Masayuki and to concentrate back to 50% KOH after the dehydrofluorination reaction (50% utilization), both KF and KOH would precipitate out. That is, by following the explicit teachings of Masayuki and concentrating to 50% KOH, there would be insufficient water to keep the KOH and KF in solution and there would be a mixture comprising KF and KOH precipitate. .

135. A person of ordinary skill in the art would not look to adding the teachings of Harrison at this point, because the addition of lime as taught by Harrison would be useless. That is, only KF and KOH precipitate would be present in Slurry Tank 24 and it would be non-sensical to a person of ordinary skill in the art to add a solid to a solid.

136. In another example, if one were to start with 30% KOH as suggested by Smith and to concentrate back to 30% KOH after the dehydrofluorination reaction (50% utilization) as taught by Masayuki, there would be, at best, a 60% mixture of KF/KOH in solution (at the border of solubility) plus a precipitate of KOH and KF salts in Slurry Tank 24.

137. A person of ordinary skill in the art would not look to adding the teachings of Harrison at this point, because the addition of lime as taught by Harrison would result in a wet cement-like mixture. A person of ordinary skill in

the art would not be motivated to work with such a cement-like mixture as it would not be very efficient. That is, some fraction of the KF may convert to KOH but much of the KOH would be trapped in solid precipitate and would not be able to be recovered as taught by Masayuki without additional extraction processes which are not contemplated by the prior art references.

138. In another example, if one were to start with 5% KOH as suggested by Smith, a person of ordinary skill in the art would simply not use this low of a concentration for a starting material as it would be highly uneconomical, the aqueous phase would constitute the majority of the reactor volume, and it would result in low yield of the desired product.

139. Accordingly, the addition of lime as suggested by Harrison to the combination of Smith and Masayuki would result in an inoperable process due to the concentration loop required by Masayuki when utilizing KOH.

140. In order to even utilize the teachings of Harrison with Smith and Masayuki with KOH, one would have to ignore the concentration steps explicitly taught by Masayuki.

141. Thus, contrary to Petitioner's assertion that "applying the converting step of Harrison to Masayuki to be straightforward, causing little to no disruption to the process of Masayuki" (Petition at p. 34), the person of ordinary skill in the

art would understand that in order for the combination to operate, Masayuki would require a substantial reconstruction and redesign of the elements shown in Figure 1 as well as a change in the basic principle under which the Masayuki process was designed to operate, namely with an enricher to concentrate the alkali metal hydroxide.

3. A Person of Ordinary Skill in the Art Would Have Had No Reason to Look to the Teachings of Harrison because Masayuki Does Not Produce Waste Water

142. Masayuki specifically states that part of the object of the invention is to “not produce wastewater during the dehydrochlorination process.” Ex. 1005 at 6:10-11.

143. Harrison is directed to “[a] process for the preparation of calcium fluoride from industrial waste waters.” Ex. 1006 at Abstract.

144. As such, a person of ordinary skill in the art would not look to Harrison in combination with Smith and Masayuki as Masayuki specifically teaches away from using waste waters.

VIII. CONCEPTION

A. Conception of Claims 1-20 of the '282 Patent

145. It is my opinion that the inventors conceived of the invention of Claims 1-20 of the '282 patent at least as early as March 26, 2008, as reflected in the March 26, 2008 email and attachments prepared by Haluk Kopkalli ("Kopkalli Email dated March 26, 2008 and associated attachments") (EX2007).

It is my opinion that the Kopkalli Email dated March 26, 2008 and associated attachments reflect the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention, as it is thereafter to be applied in practice, as reflected in the drawings from the Kopkalli Email (EX2007).

146. Indeed, the Kopkalli Email dated March 26, 2008 and associated attachments reveals that the idea was definite and permanent enough that one skilled in the art could understand the invention without extensive research or experimentation. The Kopkalli Email dated March 26, 2008 and associated attachments encompasses all limitations of the claimed invention.

147. Accordingly, it is my opinion that the inventors conceived of the invention of Claims 1-20 of the '282 patent at least as early as March 26, 2008.

That is, it is my opinion that the inventors had possession of the invention claimed in claims 1-20 of the '282 patent at least as early as March 26, 2008.

IX. CONCLUSION

148. Based on my findings above, it is my opinion that Smith, Masayuki, and Harrison fail to disclose all of the elements of claims 1-20 of the '282 Patent.

149. It is my further opinion that a person of ordinary skill in the art would not have, without knowledge of the '282 patent, looked beyond Smith in order to formulate a more efficient process for manufacturing 1234yf or fluoroolefins generally.

150. While the claims may be read broader, it appears that Petitioner has limited itself to the use of KOH as the alkali metal hydroxide to be used as its proposed combination includes Smith, Masayuki, and Harrison. Harrison, which is directed to a process for the preparation of calcium fluoride (CaF_2) from industrial waste waters, only utilizes the specific alkali metal hydroxide KOH and makes no disclosure of any other alkali metal hydroxide.

151. It is my further opinion that a person of ordinary skill in the art would not look to Harrison in combination with Smith and Masayuki as Masayuki specifically teaches away from using waste waters.

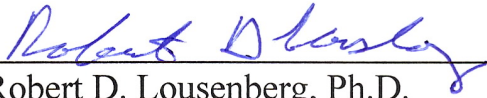
152. It is also my opinion that the inventors conceived of the invention of Claims 1-20 of the '282 patent at least as early as March 26, 2008.

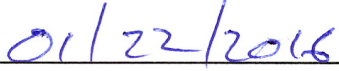
Declaration of Robert D. Lousenberg, Ph.D.

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I hereby declare that all statements made herein of my own knowledge are true and that all opinions expressed herein are my own; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Robert D. Lousenberg, Ph.D.


Date