

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SYMRISE AG,)
Petitioner,)IPR No.
vs.)2023-01035
INOLEX, INC.,)
Patent Owner.)
-----)

DEPOSITION OF DOUGLASS TABER, Ph.D.
WASHINGTON, D.C.
JUNE 11, 2024

REPORTED BY: Tina Alfaro, RPR, CRR, RMR

1 Deposition of DOUGLASS TABER, Ph.D., held
2 at the offices of:

3
4 Polsinelli
5 1401 I Street, NW
6 Washington, D.C.

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8 Taken pursuant to notice before Tina M.
9 Alfaro, a Notary Public within and for the District
10 of Columbia.

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10 BY: AARON LUKAS, ESQ.

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1 (Witness sworn.)

2 WHEREUPON:

3 DOUGLASS TABER, Ph.D.,
4 called as a witness herein, having been first duly
5 sworn, was examined and testified as follows:

6 EXAMINATION

7 BY MR. LUKAS:

8 Q. Thank you for making time for this
9 deposition today, Dr. Taber.

10 And I just want to introduce into the
11 record two documents at the get-go. One is a
12 notice of deposition in Case No. IPR-2023-01035,
13 and the other one is a notice of deposition in Case
14 No. IPR-2023-01439. So are you aware you're here
15 today to testify in both of these IPR proceedings?

16 A. Yes.

17 Q. Okay.

18 Now, the one involves U.S. Patent Number,
19 the first, 10,995,048. The second one involves
20 U.S. Patent No. 10,882,803; is that right?

21 A. Yes.

22 Q. Is it okay if I refer to those as the '048

1 and '803 Patents?

2 **A. Sure.**

3 Q. And believe you gave an earlier deposition
4 related to the '048 Patent; is that right?

5 **A. Yes.**

6 Q. Would your opinions there in that
7 proceeding, in that deposition also apply to the
8 '803 Patent?

9 **A. Yes.**

10 Q. Do you understand today that you're under
11 oath?

12 **A. Yes.**

13 Q. Is there any reason that you can't provide
14 truthful and accurate testimony today?

15 **A. No.**

16 Q. Okay. You're not on any medications?

17 **A. No.**

18 Q. Okay. The only -- and I think we've been
19 over this before. If I ask a question, I just ask
20 that if you -- if you answer the question I'm going
21 to assume you understood it. Is that okay?

22 **A. Sure.**

1 Q. If you need me to clarify anything, just
2 please ask and I'll try to ask a better question.
3 Is that okay?

4 **A. Sure.**

5 Q. And let's try not to talk over each other
6 for the benefit of the court reporter. Unless your
7 counsel -- he may object to a question from time to
8 time. Unless he instructs you not to answer, then
9 I ask that you please answer my question to the
10 best of your ability. Is that okay?

11 **A. Sure.**

12 Q. All right.

13 Now, I believe you have in front of you
14 what's been marked as Exhibit 1038; is that
15 right? It should be in the bottom right-hand
16 corner.

17 **A. I have 01035. I don't know -- oh, 1038.**
18 **Thank you.**

19 Q. There we go. Exhibit 1038. And this is
20 your second declaration that's in the IPR involving
21 the '048 Patent; is that right?

22 **A. Yes.**

1 Q. And this I believe was signed May 1st,
2 2024; do you remember that?

3 **A. Yes.**

4 Q. Now, I think you gave testimony earlier in
5 2024, it was in January or February; do you recall?

6 **A. The previous deposition?**

7 Q. Yes.

8 **A. Yes.**

9 Q. And just to close the loop on your CV, is
10 there anything that you need to update in terms of
11 your curriculum vitae between earlier this year and
12 now? Have you been involved in any other
13 consulting work? Have you given any other
14 testimony?

15 **A. No.**

16 Q. Okay. And I assume you're still retired?

17 **A. Yes.**

18 Q. So you have your first declaration and
19 your second declaration. What did you do to
20 prepare this second declaration?

21 **A. There's some questions that had come up**
22 **that needed clarification. So we looked through**

1 **additional sources to clarify those questions.**

2 Q. Okay. And what were those additional
3 sources you looked to?

4 A. **I believe they're listed here.**

5 Q. Okay. And you're at pages 4, 5, 6, and 7;
6 is that right?

7 A. **Yes. To do this precisely we would have**
8 **to compare it to the list from the first**
9 **declaration, but my recollection is that that list**
10 **ended with 32 and that 33 through 38 are additional**
11 **for this declaration.**

12 Q. Okay. And how did you find these
13 additional documents listed at 33 through 38?

14 A. **For the questions that had come up was**
15 **preparation of the alumina catalyst. So we were**
16 **looking for more specific experimental evidence for**
17 **optimizing the alumina catalysts.**

18 Q. Okay. When you say "optimize," what do
19 you mean?

20 A. **We expect a catalyst to work effectively**
21 **and efficiently, and optimized catalysts will work**
22 **effectively and efficiently.**

1 Q. Okay. And what are the factors that a
2 person of ordinary skill in the art would look at
3 for efficiency and effectiveness?

4 A. That would depend on their objective.

5 Q. Okay. So if you're trying to dehydrate an
6 alcohol like I think this case involves, what would
7 be the parameters you would look at?

8 A. The parameters we would consider were --
9 would be conversion of the starting alcohol and
10 yield of the product alkene and regioselectivity of
11 the dehydration, which really is a misnomer. What
12 we see as poor regioselectivity is usually
13 subsequent alkene migration.

14 THE REPORTER: I'm sorry, Doctor. What
15 type of selectivity?

16 THE WITNESS: Regioselectivity,
17 R-E-G-I-O-S-E-L.

18 Q. I think you mentioned that's a misnomer
19 because -- why is that a misnomer?

20 A. The dehydration initially makes the
21 1-alkene.

22 Q. Okay. And why does the 1-alkene move when

1 the process occurs by a catalytic process?

2 **A. The catalyst can cause migration of the**
3 **alkene.**

4 Q. Okay. And how does it do that?

5 **A. In a simplistic version, protonation of**
6 **the alkene followed by deprotonation can lead to**
7 **the alkene moving.**

8 Q. Okay. Is that a temperature-dependent
9 reaction?

10 **A. Most reactions proceed more readily at**
11 **higher temperature.**

12 Q. And is that -- is that migration specific
13 to this heterogeneous catalysis that's at issue in
14 this case, or is it also applicable to solution
15 phase catalysis?

16 **A. The migration can also occur with solution**
17 **phase catalysis.**

18 Q. Okay. Does -- but is it fair to say that
19 the heterogenous phase catalysis does not involve a
20 carbocation formation?

21 **A. The heterogenous catalysis occurs on the**
22 **surface of the alumina and the precise mechanisms,**

1 **probably plural, probably have not been elucidated.**

2 Q. Okay. So is it fair to say that the
3 catalyst when you put it into a reactor is a little
4 bit of a black box, you put stuff in and you see
5 what comes out but don't really know what's going
6 on inside?

7 **A. No, I don't think that's a fair**
8 **characterization.**

9 Q. Okay. How would you characterize the
10 reaction, then? I think you said that it hasn't
11 been elucidated, but we know a little bit about
12 what's going on in there, right?

13 **A. We know a great deal about what's going**
14 **on. The...**

15 Q. And what would that include?

16 **A. People know about surface area of the**
17 **catalyst, they know about pore size, they know**
18 **about structure, macrostructure of the catalyst.**

19 Q. So how does pore size affect the
20 dehydration of an alcohol to an alkene by an
21 alumina catalyst?

22 **A. There's a great deal in the literature**

1 **about that. It would be very difficult for me to**
 2 **summarize it in an answer. The...**

3 Q. Okay. Well, generally speaking, is there
 4 a pore size above which you wouldn't want to go or
 5 below which you wouldn't want to go or is there an
 6 optimum pore size based on your review of the
 7 literature?

8 A. The primary focus of the literature is on
 9 catalyst surface area.

10 Q. Okay.

11 A. Measured by BET.

12 Q. So is it fair to say pore size really
 13 isn't that important as long as you have enough
 14 surface area?

15 A. Pore size is discussed in great detail in
 16 the general catalyst literature. I've not
 17 expressed an opinion anywhere in my report about
 18 pore size.

19 Q. Okay. Would a POSITA, a person of
 20 ordinary skill in the art, if it's okay if I use
 21 that term, would a POSITA believe that pore size
 22 was important in selecting a catalyst?

1 **A. A POSITA guided by the sources to be cited**
 2 **here would understand the importance of surface**
 3 **area of the catalyst.**

4 Q. Okay, but my question was about pore size,
 5 not surface area. Would a POSITA --

6 **A. Nothing at all in this report addresses**
 7 **pore size.**

8 Q. Okay. So turning to surface area, what
 9 would a POSITA look at in terms of selecting a
 10 catalyst based on its surface area?

11 **A. The POSITA would be looking at procedures**
 12 **for catalyst preparation that optimized, usually**
 13 **maximized BET.**

14 Q. So is it fair to say that a POSITA would
 15 believe that more surface area is better in terms
 16 of selecting a catalyst?

17 **A. A POSITA would be guided by the literature**
 18 **to sufficient BET.**

19 Q. Okay. So is it fair to say a POSITA would
 20 recognize there has to be at least a minimum
 21 surface area and above that it may not matter so
 22 much; is that right?

1 **A. The POSITA would be guided toward typical**
 2 **BET for an active catalyst.**

3 Q. Okay. What is a typical BET?

4 **A. We would have to look at the -- at the**
 5 **sources for the report to answer that question.**

6 Q. Let me ask you this question. Would a
 7 POSITA expect that most, if not all, commercially
 8 available alumina catalysts would have sufficient
 9 surface area to catalyze a dehydration of an
 10 alcohol to an alkene?

11 **A. The POSITA would recognize that commercial**
 12 **alumina is highly variable and that there are**
 13 **procedures to prepare catalysts from the commercial**
 14 **alumina.**

15 Q. Okay. Are most commercially available
 16 alumina catalysts described by their surface area?

17 **A. I think we're confusing two different**
 18 **terms. Alumina -- gamma-alumina can be purchased.**
 19 **There are certainly commercial alumina catalysts.**
 20 **We should not confuse those two things.**

21 Q. Okay. What's the difference between
 22 gamma-alumina that you can purchase, say, from

1 Aldrich or another supplier and a commercial
2 alumina catalyst?

3 **A. The commercial alumina catalysts have been**
4 **prepared by procedures that might, for instance,**
5 **include calcining, they might include treatment**
6 **with other chemicals in the process.**

7 Q. Okay. So just so -- to make sure I
8 understand, when we say commercially available
9 gamma -- gamma-alumina, we're referring to
10 untreated gamma-alumina; is that fair?

11 **A. The term "commercial gamma-alumina" could**
12 **include gamma-alumina catalysts.**

13 Q. Okay. So let me ask you this. A person
14 of ordinary skill in the art who wanted to do a
15 dehydration of an alcohol to make an alkene, would
16 they choose a commercially available gamma-alumina
17 or just a commercially available catalyst from a
18 company? What would be the preferred choice for a
19 POSITA?

20 **A. If a POSITA could find a source of a**
21 **reliable gamma-alumina dehydration catalyst, they**
22 **might well choose to use that.**

1 Q. What is a reliable gamma-alumina
2 dehydration catalyst? What does that mean?

3 A. As a for instance, the dehydration of
4 1-alcohols to 1-alkenes is practiced on a
5 commercial scale, on a metric ton scale. If a
6 catalyst is used for that purpose, it would
7 probably be sufficient for the POSITA.

8 Q. Okay. So is it your testimony that a
9 POSITA would first turn to a commercially available
10 gamma-alumina catalyst from a company that sells
11 such things?

12 A. If it was available.

13 Q. Okay. And it's fair to say that there's a
14 number of companies that do sell gamma-alumina
15 catalysts for these dehydration reactions, right?

16 A. We speak of gamma-alumina -- of a
17 gamma-alumina catalyst that is sufficient for the
18 desired dehydration, and I do not know if such
19 would be commercially -- would be available
20 commercially to the POSITA.

21 Q. Okay. And if a -- and when you say "for
22 the desired dehydration," do you mean the specific

1 alcohol that's being dehydrated?

2 **A. The dehydration in question is of a**
3 **primary alcohol to the 1-alkene. So the POSITA**
4 **would be searching for a catalyst that was**
5 **effective for carrying out that dehydration.**

6 Q. Okay. And how would the identity of the
7 primary alcohol affect that decision? In other
8 words, if I was trying to -- a POSITA was trying to
9 dehydrate a 1-butanol versus 1-octanol, would you
10 expect that the same catalyst would work in both
11 cases?

12 **A. The concern with 1-butanol is that it**
13 **would often contain significant -- more water than**
14 **the 1-octanol, and the POSITA might be concerned**
15 **about how this catalyst would hold up to the -- out**
16 **to the water. However -- so they might be**
17 **different.**

18 Q. Okay. I think you mention that in your --
19 in your second declaration. And isn't it true that
20 regardless of the 1-alcohol that's being
21 dehydrated, water is a product of the dehydration
22 reaction, right?

1 **A. Yes.**

2 Q. And so if we're dealing with, say,
3 1-octanol and we're making water and we're doing
4 this in a high rate of conversion, there's going to
5 be at least 10 percent alcohol in that effluent
6 stream; is that right?

7 **A. 10 percent alcohol?**

8 Q. Sorry. 10 percent water. Let me -- let
9 me reask that question, Doctor.

10 So if we're dealing with 1-octanol and
11 generating water by dehydration, is it fair to say
12 that there would be at least about 10 percent water
13 in that effluent stream flowing through the
14 reactor; is that fair?

15 **A. There would be a significant amount of**
16 **water and, of course, it would be in the gas state.**

17 Q. Right. And same thing for let's say we're
18 talking about 1-butanol which contains some water.
19 I believe typical temperatures for these
20 dehydration reactions are 250 to 400 C; is that
21 right?

22 **A. Yes.**

1 Q. And so those reagents are going to be in
2 the gas phase as well, right?

3 A. Those reagents?

4 Q. Those reagents being butanol and water.

5 A. Yes.

6 Q. Okay. So why does it make a difference if
7 there's water present in 1-butanol versus less
8 water present in the octanol because you're
9 generating water in both cases, right?

10 A. There would be more water with the -- in
11 proportion there would be more water with the
12 1-butanol.

13 Q. Okay. How much more water?

14 A. It depends on the water content of the
15 1-butanol that was charged.

16 Q. Okay. How much water would a POSITA
17 expect there to be present in 1-butanol versus
18 1-octanol? Would you expect to see a significant
19 difference between those two?

20 A. A POSITA would understand that water is
21 more soluble in 1-butanol than it is in 1-octanol.

22 Q. Okay. So would a POSITA believe that a

1 catalyst that works for 1-butanol and does a good
2 job, would there be an expectation it would also
3 work for 1-octanol?

4 **A. Yes.**

5 Q. Okay. So a POSITA wouldn't think that
6 that water would make a difference; is that fair?

7 **A. The concern of the POSITA for dehydrating**
8 **1-butanol is the larger amount of water. Moving to**
9 **1-octanol would be a favorable direction in terms**
10 **of water content of the charged alcohol.**

11 Q. Okay. So more water is typically bad; is
12 that right?

13 **A. The POSITA might be concerned about the**
14 **excess water in the 1-butanol.**

15 Q. And why would that be?

16 **A. A POSITA would not expect excess water to**
17 **help the reaction.**

18 Q. Okay. Would a POSITA expect that the
19 water present in either 1-octanol as a result of a
20 reaction, the dehydration reaction, or the water
21 present in 1-butanol would adversely affect the
22 efficiency of the catalyst?

1 **A. The POSITA would be well aware based on**
2 **the literature that 1-octanol can be dehydrated**
3 **efficiently with a gamma-alumina catalyst.**

4 Q. Okay. In other words, you're saying that
5 a POSITA would not expect the 10 to 12 percent
6 water or 10 to 15 percent water that forms as a
7 result of the dehydration to adversely affect the
8 catalyst?

9 **A. The POSITA would understand from the**
10 **literature that such dehydrations have been carried**
11 **out efficiently on a large scale.**

12 THE REPORTER: I'm sorry. That such
13 dehydrations --

14 THE WITNESS: That such dehydrations have
15 been carried out efficiently on a large scale.

16 Q. Okay. Turning back to Exhibit 1038, we
17 were talking about these new documents which are
18 listed here as 33 through 38. Do you see those?

19 **A. Yes.**

20 Q. So the first one is Takamura, which I
21 think is discussed in a couple places in your
22 declaration. How did you select Takamura as a

1 reference that a POSITA would rely upon?

2 **A. I really have to look at Takamura again to**
3 **be able to speak to that.**

4 Q. Okay. I'll give you a copy of Takamura.
5 Okay. So you've been handed a copy of Takamura,
6 which I believe is Exhibit 1033.

7 MR. MURPHY: 1044.

8 MR. LUKAS: Sorry. 1044. Yes, 1044.

9 All right. So do you recognize this
10 document?

11 **A. Yes.**

12 Q. And it's a copy of European Patent
13 No. 2,990,395; is that right?

14 **A. Yes.**

15 Q. Okay. We're going to call it Takamura,
16 though.

17 So Doctor, I think the question was how
18 did you determine -- or how did you identify
19 Takamura as a reference a POSITA would view as
20 being relevant to your opinions here?

21 **A. If the POSITA could purchase an efficient**
22 **gamma-alumina catalyst for the dehydration, they**

1 would do so. If they could not, they would turn to
2 the literature looking for protocols for creating
3 an efficient catalyst and Takamura addresses that.

4 Q. Okay. And how in your opinion does
5 Takamura address that or speak to the selection of
6 a catalyst for a dehydration reaction?

7 A. So, for instance, in 0045 they speak
8 about -- sorry -- Takamura speaks about metal oxide
9 catalysts, zeroing in at the end of 0045, on
10 gamma-alumina.

11 Q. Okay. Now, in this case I believe
12 Takamura is discussing the solution phase catalytic
13 dehydration; is that right?

14 A. And then in 0052 Takamura addresses
15 additives for the solid oxide catalyst.

16 Q. Okay. Let's try my question, though,
17 which is Takamura is talking about a liquid phase
18 reaction, right?

19 A. I don't believe so. If I could draw your
20 attention to 0057.

21 Q. Okay. And that's discussing the
22 preparation of the catalyst, right?

25

1 **A. Yes.**

Q. And if we look at the -- starting at paragraph 76 a couple pages later. Okay. So we're looking at the paragraph 76 discussing using an inert gas, and then we look down at paragraph 80 and at the beginning there it says "In the present invention the olefination reaction is preferably performed as liquid phase reaction"; do you see that? And -- well, do you see where I'm pointing to, Doctor, paragraph 80? It's preferably a liquid phase reaction, right?

12 (Witness reviewing document.)

13 A. With higher molecular weight alcohols they
14 speak of a liquid phase reaction, but if you turn
15 to 0096, they're talking about a reaction
16 temperature between 200 and 300 degrees.

17 Q. Right. So you're saying that the patent
18 discloses generally that you could do a reaction of
19 200 to 300 degrees, right? It's saying that right
20 under paragraph 96 at item 1, right?

21 A. They say they ran the reaction from 200 to
22 300 degrees.

1 Q. Well, I don't think they said they ran the
2 reaction. I think they say that you could run a
3 reaction at 200 to 300 degrees, correct?

4 A. Well, it says "A method for producing
5 olefin at a reaction temperature between 200 and
6 300 degrees."

7 Q. Right. And this is not in the example
8 section of the patent, is it, Doctor?

9 A. 0096.

10 Q. Yeah. So if you turn to the next page at
11 paragraph 97, there's a header that says "Example";
12 do you see that?

13 A. Yes. 0097 is talking about catalyst
14 preparation.

15 Q. Right. And if you turn to the next page,
16 it continues example 1 beginning at paragraph 98,
17 right?

18 A. Yes.

19 Q. And so this section that you were
20 referring to at paragraph 96 -- starting at
21 paragraph 96 and continuing for basically two
22 pages, these aren't examples, are they, Doctor,

1 that were actually conducted? These are just --
 2 the patent's saying you could do it in these
 3 different ways, but we didn't necessarily do it
 4 this way, right?

5 **A. Example in 0098 with a high molecular**
 6 **weight alcohols.**

7 Q. So Doctor, let's -- turning back to
 8 beginning at paragraph 96, this is not the examples
 9 section of the document, right?

10 **A. No.**

11 Q. No. And so these are --

12 **A. I beg your pardon. Yes. 0097 --**

13 Q. Sorry. No. 0096.

14 **A. Okay. But 0097 is also talking about**
 15 **catalyst preparation.**

16 Q. It is. So -- and we'll turn to there in a
 17 second, but if we're looking at 0096 and this goes
 18 from items 1 through 31, these are a list of
 19 different embodiments that could be practiced; is
 20 that fair?

21 (Witness reviewing document.)

22 **A. So they talk about a range of things here**

1 including catalyst preparation and also the kinds
2 of alcohols that might be dehydrated.

3 Q. Right. There's no indication that any of
4 these embodiments at paragraph 96 were actually
5 experimentally conducted, right?

6 A. There is no report of a dehydration of a
7 lower molecular weight alcohol used in this
8 protocol.

9 Q. Okay. And just to -- just to be clear,
10 there's no indication that the list 1 through 31 at
11 paragraph 96, that any of these embodiments were
12 specifically practiced because they're not listed
13 as examples or experimental examples, right?

14 A. I can't agree with that. It talks
15 about -- in around line 45 to 50 it's talking about
16 preparation of the aluminum oxide -- the
17 gamma-alumina catalyst and that's reiterated in the
18 examples in 0097. They were certainly practiced.

19 Q. Okay. So would it be fair to say that a
20 POSITA reviewing Takamura, if they wanted to find
21 out if an experiment was done they'd turn to the
22 examples, right?

1 **A. The POSITA is looking for a protocol for**
2 **creating an effective gamma-alumina catalyst, and**
3 **Takamura describes the preparation of an effective**
4 **gamma-alumina catalyst for doing the dehydration.**

5 Q. Right. And in order for a POSITA to know
6 that a particular catalyst would work for its
7 intended purpose, a POSITA would want to see an
8 experimental example using that catalyst, wouldn't
9 they?

10 **A. The POSITA has seen many experimental**
11 **examples. What would have motivated the POSITA**
12 **looking at Takamura is the details of catalyst**
13 **preparation which are often missing from those**
14 **examples.**

15 Q. Right, but let's try my question first,
16 which is if a POSITA wanted to see if a particular
17 catalyst worked for its intended purpose, they
18 would want to see an experimental example, right?

19 **A. Yes, and there are experimental examples**
20 **right here, the 1-alcohol is being dehydrated to**
21 **the 1-alkene.**

22 Q. Right. And so for a particular catalyst

1 and a particular dehydration of an alcohol, for a
2 POSITA to know that a catalyst would work for that
3 purpose they would look to the particular
4 experiments that use that catalyst, right?

5 **A. But not necessarily the protocols because**
6 **the POSITA would be aware of the boiling point of**
7 **1-octanol and the boiling point of 1-octene and**
8 **would be motivated to confine the 1-octene product**
9 **in such a way as to recover it.**

10 Q. So let's try the question again, Doctor,
11 because that was nonresponsive to my question,
12 which is in order to find out if a catalyst would
13 work for its intended purpose for a particular
14 substrate, a POSITA would want to see an
15 experimental example, correct?

16 **A. Yes. And there are experimental examples**
17 **in '395, in Takamura.**

18 Q. Okay. And let's take a look at those
19 experimental examples, Doctor.

20 **A. Sure.**

21 Q. If we look at paragraph 97, it discusses
22 the preparation of a catalyst. And -- are you

1 there?

2 **A. Yes.**

3 Q. And it describes a treatment of alumina
4 with sulfuric acid; is that right?

5 **A. Yes. They treat the alumina -- they get**
6 **the commercial gamma-alumina with sulfuric acid,**
7 **dilute sulfuric acid, dry that product, and then**
8 **calcine at 500 degrees C for three hours.**

9 Q. Okay. And when was the last time you
10 looked at Takamura before today?

11 **A. Yesterday.**

12 Q. Okay. Did you look at the entirety of
13 Takamura yesterday?

14 **A. Yes.**

15 Q. Okay. And I believe Takamura's general
16 objective is to dehydrate 1-alcohols and prevent
17 dimerization; is that fair?

18 **A. They mention dimerization. I don't know**
19 **if that's their primary objective.**

20 Q. Okay. Well, let's -- maybe we can agree
21 on Takamura identifies dimerization as a potential
22 issue that should be avoided; is that right?

1 **A. In 0018 they have two objectives. The**
2 **present invention can provide a method for**
3 **producing an olefin with a high yield. So that**
4 **would imply high regioselectivity, lack of**
5 **isomerization through dehydration reaction of an**
6 **aliphatic alcohol while suppressing oligomerization**
7 **of an olefin.**

8 Q. Okay. And in the example at paragraph 97,
9 in order to achieve that Takamura is saying you can
10 treat a gamma-alumina catalyst with sulfuric acid
11 and then dry it at 120 degrees C and then calcine
12 it at 500 degrees C in air; is that right?

13 **A. Yes.**

14 Q. Now, most of the other catalysts that we
15 will look at that are cited in the -- in the prior
16 art deal with base treatment; is that right?

17 **A. The commercial catalyst that Sasol uses is**
18 **the product of treatment with calcium acetate**
19 **followed by calcination.**

20 Q. And why did you specifically reference a
21 commercial catalyst from Sasol?

22 **A. Because the Sasol catalyst is used to**

1 **carry out the desired dehydration of 1-octanol to**
2 **1-octene.**

3 Q. Is the Sasol catalyst commercially
4 available?

5 A. **If the Sasol catalyst were available to**
6 **the POSITA, they would purchase it and use it.**

7 Q. Okay. And so if a POSITA knew about the
8 Sasol catalyst, why would they look at Takamura?

9 A. **The only Sasol patent that we have is**
10 **De Bruyn, and De Bruyn does not focus on the exact**
11 **procedure for catalyst preparation.**

12 Q. Okay. So is it your opinion that a POSITA
13 not knowing how the Sasol catalyst was prepared
14 would try to review the literature to design a
15 similar catalyst?

16 A. **Yes. In reviewing the literature they**
17 **would -- the POSITA would learn that the**
18 **gamma-alumina catalyst is treated often with**
19 **another agent and then dried and calcined. He**
20 **would want to know dried for how long, calcined for**
21 **how long at what temperature, and Takamura would**
22 **teach those things.**

1 Q. Okay. I think you testified that the
2 Sasol catalyst is treated with calcium hydroxide;
3 is that right?

4 A. I said calcium acetate. We know that the
5 Sasol catalyst contains calcium salts.

6 Q. How do you know that?

7 A. Because De Bruyn says so.

8 Q. Okay. And Takamura discloses treatment
9 with sulfuric acid, right?

10 A. Yes.

11 Q. So why would a POSITA view the preparation
12 procedures of Takamura which uses sulfuric acid as
13 relevant to a catalyst that would be treated with
14 calcium acetate?

15 A. That would get us -- the answer to that
16 question would get us to Chokkaram,
17 C-H-O-K-K-A-R-A-M.

18 Q. And so is it your testimony that Takamura,
19 this procedure here, doesn't really have much
20 applicability to calcium acetate treated alumina?
21 You'd have to look elsewhere?

22 A. No, that is not my testimony.

1 Q. Okay.

2 A. My testimony -- the question you asked was
3 about calcium acetate as opposed to, say, sulfuric
4 acid. Takamura is valuable in talking about time
5 and temperature of calcination of a treated alumina
6 catalyst. Chokkaram goes on to explain why, that
7 time and temperature of calcination is important.

8 Q. Okay. And just so we're clear, when we
9 say calcination, do you agree that calcination --
10 generally a POSITA would understand that term to
11 mean a time and temperature that completes a
12 reaction?

13 A. Usually when we speak of a reaction we
14 speak of starting material or starting materials to
15 be converted to product or products. The
16 circumstances of calcination of a gamma-alumina
17 catalyst could perhaps be termed a reaction because
18 a chemical change -- or a structural change is
19 taking place.

20 Q. Okay.

21 Now, the -- turning back to the catalyst
22 of Takamura, treatment with sulfuric acid, is that

1 going to result in any sulfur or sulfur species
2 being chemically incorporated into the alumina?

3 **A. Takamura does not report any analysis of**
4 **the resulting catalyst.**

5 Q. Okay. But what would a POSITA understand
6 about treatment with sulfuric acid? Would a POSITA
7 expect that sulfur-containing species would be
8 incorporated into the catalyst?

9 **A. A POSITA would have no way of knowing.**

10 Q. Okay. And I think we talked about
11 calcination as being a way to accomplish a chemical
12 reaction, the chemical reaction being something
13 related to a change in the alumina; is that right?

14 **A. Yes.**

15 Q. So if sulfuric acid or a sulfur species
16 were being incorporated into the alumina, then
17 would a POSITA expect that calcination would be
18 required?

19 **A. Takamura would teach the POSITA to calcine**
20 **the gamma-alumina after sulfuric acid treatment.**

21 Q. Okay. Takamura doesn't include an example
22 where the catalyst is not calcined; is that fair?

1 **A. As they speak of preparing their**
 2 **gamma-alumina catalysts, the only example they have**
 3 **is calcined.**

4 Q. Okay. And there's also some discussion
 5 of -- in the literature of base treatment. Do you
 6 recall reading about base treatment of alumina
 7 catalysts?

8 **A. Yes.**

9 Q. And I think we talked about this last
 10 time. Base treatment generally refers to reaction
 11 of a base with an acidic site on the alumina; is
 12 that fair?

13 **A. That's a simplification. The simplest**
 14 **explanation -- the simplest answer to that is yes.**
 15 **The situation actually is more complex than that**
 16 **because alkaline earth metals are oxyphilic,**
 17 **O-X-Y-P-H-I-L-I-C, oxyphilic. So in the actual**
 18 **catalyst structure the role that calcium may be**
 19 **more than just neutralizing an acidic site.**

20 Q. In the case of calcium; is that right?

21 **A. Yes.**

22 Q. Okay. And we'll talk a little bit about

1 that later. Let's turn back to Takamura and if we
2 go to the next page, which is starting at paragraph
3 98, there's a discussion of the olefination
4 reaction; do you see that?

5 **A. Oh, I see. So olefination reaction is the**
6 **heading above 98?**

7 Q. Right. And so in the 98 there's a
8 discussion that I think hexane -- sorry --
9 hexadecanol and octadecanol were dehydrated in this
10 example, right?

11 **A. Yes.**

12 Q. And these were done in the solution phase;
13 is that right?

14 **A. I don't know the boiling point of**
15 **octadecanol. And so I cannot reliably answer that.**
16 **Do you have that information?**

17 Q. Well, it says that a four-neck flask
18 equipped with a stirrer was charged with the
19 hexadecanol and octadecanol and they were stirred
20 at 280 degrees C with nitrogen flowing in the
21 system. So is it your understanding or would a
22 POSITA understand that this was done in solution?

1 **A. This was done in suspension. The catalyst**
2 **would not have been soluble.**

3 Q. Right. So it was a liquid that was mixed
4 with a solid catalyst, right?

5 **A. Yes.**

6 Q. Okay.

7 **A. And presumably stirred, although they do**
8 **not say that.**

9 Q. Okay. So -- and in this case Takamura is
10 saying -- well, let's see. The yield is provided I
11 think over here in table 1 on the next page; do you
12 see that?

13 **A. Yes.**

14 Q. And for example 1 Takamura provides a
15 yield of olefin of 97.3 percent; is that right?

16 **A. Yes.**

17 Q. And I believe examples 1 through 10 in
18 this table use this acidic catalyst and vary the
19 alcohol raw materials to some extent and also vary
20 the mass ratios and the temperatures and the times;
21 do you see that?

22 **A. There are apparently four different**

1 **catalysts in table 1.**

2 Q. Uh-huh.

3 **A. We have gamma-alumina, we have**
4 **S04/gamma-alumina, we have silica-alumina, and we**
5 **have gamma-alumina powder.**

6 Q. Right. And Takamura only describes the
7 preparation of a single catalyst at paragraph 97,
8 right?

9 **A. Yes. I assume that that is the**
10 **S04/gamma-alumina in, shall we say, example 6.**

11 Q. I believe that is example 6 saying
12 S04/gamma-alumina, right.

13 And then if we turn to the next page,
14 table 2, Doctor, there's a list of comparative
15 examples; do you see that?

16 **A. In table 2?**

17 Q. Table 2, yeah.

18 **A. Yes.**

19 Q. And I believe the main difference between
20 table 1 and table 2 is that in table 1 you have a
21 mixture of alcohols and in table 2 you have a
22 single alcohol being dehydrated; do you see that?

1 **A. I believe example 11 is two alcohols.**

2 Q. It is, yeah.

3 **A. The others are single alcohols.**

4 Q. Right. There's no -- there's no alcohol
5 conversion or yield given for example 11?

6 **A. No.**

7 Q. And so if we look at example 1 on table 1
8 versus comparative example 1 in table 2, the
9 conditions look pretty similar except for the
10 reaction time, I believe example 1 is nine hours,
11 example -- comparative example 1 is ten hours, but
12 the only other difference is the mixture of
13 alcohols versus a single alcohol; is that fair?

14 **A. Yes.**

15 Q. And comparative example 1 is showing a
16 yield of 94.4 percent for a single alcohol versus a
17 yield of 97.3 percent for the mixture; is that
18 right?

19 **A. Yes.**

20 Q. So would a POSA reviewing Takamura view
21 this data as being relevant to the dehydration of a
22 C6 alcohol?

1 A. The challenge with the lower molecular
2 weight alcohols is the alkene is even lower
3 molecular weight and a POSITA would also have read
4 about running the reaction efficiently in a tubular
5 reactor and collecting the products and might well
6 conclude from Takamura he knows how to make -- that
7 they know how to make the catalyst but that doing
8 it -- stirring 1-octanol in an open flask might not
9 be the smartest thing.

10 Q. Right. So based on that, why would a
11 POSITA view Takamura as being relevant to
12 dehydrating a lower molecular weight alcohol such
13 as hexanol or octanol?

14 A. The POSITA would be motivated to read
15 Takamura and follow Takamura because if we look at
16 the entry example 6, we have the calcined catalyst,
17 prepared and calcined, giving a 94.7 percent yield
18 of olefin for the high molecular weight olefins,
19 and we conclude that as long as they were careful
20 to collect the octane that came out, they would get
21 efficient conversion using a calcined alumina
22 catalyst of the 1-octanol to 1-octene.

1 Q. But that's an acid treated then calcined
2 gamma-alumina catalyst, right?

3 **A. It is sulfuric acid treated and then**
4 **calcined catalyst.**

5 Q. Would a POSITA reviewing Takamura be
6 motivated to use that same sulfuric acid treated
7 gamma-alumina catalyst?

8 **A. The POSITA would certainly be motivated to**
9 **follow the instructions of Takamura on how to**
10 **prepare a catalyst. Takamura lists many additives**
11 **as possible. And so if the POSITA wanted to find**
12 **the best additive to use following this protocol,**
13 **they might refer to other literature. We have no**
14 **evidence for a sulfated gamma-alumina catalyst**
15 **being used to dehydrate 1-octanol.**

16 Q. Right. So -- and if we look at table 1 in
17 Takamura, which is the table that summarizes the
18 examples of the invention --

19 **A. Yes.**

20 Q. -- only one of those catalysts is
21 modified, right?

22 **A. The sulfated gamma-alumina catalyst is in**

1 **example 6, and the POSITA might be motivated to use**
2 **that catalyst.**

3 Q. Okay. All the other catalysts are just
4 gamma-alumina or silica-alumina or gamma-alumina
5 powder, right?

6 A. Yes. We have no information about where
7 that gamma-alumina came from or how it was
8 treated.

9 Q. Right. No idea if it was modified or
10 calcined or anything about it, right?

11 A. Takamura says nothing.

12 Q. So the only example of a modified catalyst
13 that Takamura provides is the sulfated or sulfuric
14 acid treated gamma-alumina in the examples, right?

15 A. Yes. Once in table 1 and twice in table
16 2.

17 Q. Okay.

18 THE REPORTER: When you get to a good spot
19 for a break.

20 MR. LUKAS: We can go off the record.

21 (A break was had.)

22 BY MR. LUKAS:

1 Q. All right. We're back on the record,
2 Doctor.

3 So I just wanted to close the loop on
4 Takamura before we move on. So looking at table 1
5 and table 2 with the description of the
6 S04/gamma-alumina; do you see that?

7 **A. Yes.**

8 Q. Would that indicate to a POSITA that
9 sulfate was actually incorporated into the
10 gamma-alumina?

11 **A. The S04/gamma-alumina at the top of the**
12 **table indicates the method of preparation. There**
13 **is no analytical evidence for the presence of**
14 **sulfur in that catalyst.**

15 Q. Okay.

16 Now, I think we talked a little bit about
17 how or whether a POSITA would take the teachings of
18 Takamura and extend them to other catalysts; do you
19 remember that?

20 **A. Yes.**

21 Q. And is it your opinion that a POSITA would
22 review the catalyst preparation in Takamura at

1 paragraph 97 and be able to apply that to other
2 gamma-alumina catalysts that weren't treated with
3 sulfuric acid but instead were treated with
4 something different?

5 **A. Yes.**

6 Q. And why is that?

7 **A. Again, informed by Chokkaram, the POSITA**
8 **would understand from Takamura the detailed**
9 **procedures for drying followed by calcination.**

10 Q. Okay. So is it your testimony that a
11 POSITA reviewing Takamura would be motivated to do
12 a calcination step after a treatment with a
13 chemical species?

14 **A. Yes.**

15 Q. And why is that?

16 **A. Again, going to Chokkaram, recalcination**
17 **optimizes the surface area of the catalyst.**

18 Q. And why would a POSITA reviewing Takamura
19 turn to Chokkaram?

20 **A. We would need to go to Chokkaram to talk**
21 **about it. Do you have a copy there?**

22 Q. I can give you a copy of Chokkaram. And

1 for the record, Chokkaram is spelled
2 C-H-O-K-K-A-R-A-M. I'm going to hand you a copy of
3 Chokkaram which is Exhibit 1041.

4 So I think the question was why would a
5 POSITA reviewing Takamura turn to Chokkaram?

6 A. If you turn to page 160, table 1.

7 Q. Okay.

8 A. This is speaking about -- table 1
9 addresses calcination temperature and these are in
10 degrees K. You have to subtract 273 to get
11 degrees C which are more familiar to us.

12 Q. Yep.

13 A. So I often refer to a temperature that's
14 not on the table. So I think of 673 as being 400
15 to put things back in a familiar parlance we've
16 been using in the previous discussion.

17 And so we see reading table 1 that with
18 increasing calcination temperature the surface area
19 increases and then with too high of a temperature
20 it falls off again.

21 Q. Okay.

22 A. We want to optimize the surface area, that

1 gives us a range we might think about.

2 Q. So Chokkaram, this is talking about making
3 alumina that has a stoichiometric amount of cobalt
4 or nickel that is a part of a particular structure
5 but it's uniformly distributed through the catalyst
6 structure; is that fair?

7 A. In the experimental section on page 158,
8 2.1, catalyst preparation, the molar ratio of
9 alumina to cobalt or alumina to nickel is 2 to 1,
10 2.0.

11 Q. Right.

12 A. They precipitate the alumina from that
13 solution and then take that precipitate and still
14 prepare their catalyst. I don't see any evidence
15 in 2.1 of the amount of cobalt or the amount of
16 nickel in the precipitate.

17 Q. Right. And if you look at the table 1 and
18 table 2 on the following page, 160, the amount of
19 cobalt and the amount of nickel is given as -- for
20 cobalt it is two moles of aluminum for one mole of
21 cobalt in the structure as reported by XRD; do you
22 see that?

1 **A. I'm sorry. No, I don't. Where are you**
2 **looking?**

3 Q. I believe it's the fourth column. It says
4 "XRD phases"; do you see that?

5 **A. Yes.**

6 Q. Table 1.

7 **A. Yes.**

8 Q. And underneath there it says "Cobalt,
9 CoAL204 and traces of Co203"?

10 **A. I do see that.**

11 Q. Okay.

12 **A. But that's not teaching me how much total**
13 **cobalt is there. It just starts with the cobalt**
14 **species that are there.**

15 Q. Right. And as calcination temperature is
16 increased you have at 773 formation of cobalt
17 dialumina tetraoxide?

18 **A. Yes. By XRD all the cobalt seems to**
19 **become primarily a single species.**

20 Q. That's right.

21 And have you used XRD, Doctor?

22 **A. I have not, but I'm very aware of it.**

1 Q. Right. So are you aware that XRD is used
2 to measure crystalline structure?

3 A. I see that here, but what I don't know
4 from this table is how much noncomplexed alumina is
5 also present. It is speaking about what species of
6 cobalt is there, but it does not say if there's any
7 noncomplexed alumina also present.

8 Q. Right. And if noncomplexed alumina were
9 also present, wouldn't you expect that to be
10 reported?

11 A. This particular table is addressing the
12 nature of the cobalt. And so I have no expectation
13 that noncomplexed alumina would be reported.

14 Q. Right. And would a POSITA understand that
15 the cobalt is uniformly distributed in a regular
16 pattern that's measured by XRD based on this table?

17 A. A simple chemical analysis would quickly
18 ascertain how much total cobalt and how much total
19 aluminum was there. Such an analysis is not
20 reported here.

21 Q. Right. And if we look at the catalyst
22 preparation, the ratio of aluminum to cobalt was 2

1 to 1 and the ratio that's reported here is also 2
2 to 1 in the XRD phases, correct?

3 **A. It reports a species that is 2 to 1**
4 **aluminum to cobalt.**

5 Q. Right. And so if we're talking about
6 calcination in the context of Chokkaram, the
7 calcination is taking a precipitate and forming a
8 crystalline material; is that right?

9 **A. We know that this is -- that this product**
10 **after calcination initially states 773 appears to**
11 **be well defined.**

12 Q. Right. And would a POSITA understand the
13 calcination is causing formation of the crystalline
14 lattice in this case?

15 **A. The POSITA would also understand that as**
16 **the temperature's elevated the cobalt species stays**
17 **the same, but the structure is clearly changing.**

18 Q. Right. The surface area is decreasing and
19 the pore volume is also slightly decreasing; is
20 that fair?

21 **A. Yes.**

22 Q. And --

1 **A. The crystallite sizes are also changing.**

2 Q. Right. And if we look at the -- page 160
3 in the second column, around halfway down there's a
4 sentence that says "Below 468 Kelvin a gradual loss
5 of weight and the evolution of both water and
6 carbon dioxide is observed in figure 1"; do you see
7 that?

8 **A. I do see where that phrase is.**

9 Q. And so would a POSITA understand that as
10 being -- strike that.

11 Would a POSITA understand that the loss of
12 both water and carbon dioxide is due to formation
13 of the crystalline cobalt aluminum oxide lattice?

14 **A. The POSITA would understand that the**
15 **carbon dioxide came from the ammonium carbonate,**
16 **but nothing about this talks about the actual**
17 **cobalt-aluminum ratio.**

18 Q. Well, it's given in the table above,
19 right, table 1?

20 **A. We know what the cobalt species is.**

21 Q. Right.

22 **A. But we don't know what the bulk material**

1 **is.**

2 Q. Right. And if we look at the next page,
3 figure 3, page 161, we actually have peaks in the
4 XRD for the cobalt-alumina mixed oxide catalyst; do
5 you see that?

6 **A. Yes.**

7 Q. And those peaks in the XRD are actually
8 given -- it's correlating the different lattice
9 parameters for the cobalt-aluminum oxide; do you
10 see that?

11 **A. The caption is "The effect of calcination**
12 **temperature on the crystallinity of cobalt-alumina**
13 **co-precipitated mixed oxide catalyst." So going**
14 **from A up to E on top and certainly the XRD gets**
15 **sharper as we go up.**

16 Q. Right. So the material's becoming more
17 crystalline as you increase the calcination
18 temperature; is that fair?

19 **A. Yes, although we note that we're starting**
20 **to get more chatter off on the right-hand side.**

21 Q. Right.

22 **A. Which is not labeled as belonging to the**

1 **crystal. So this is chatter.**

2 Q. Right. If we look back at column 2 of
3 page 160, before the sentence we read earlier
4 there's a discussion of the cobalt-alumina
5 precipitate which identifies particular species as
6 being aluminum trihydroxide and cobalt dihydroxide;
7 do you see that?

8 A. No. I'm sorry. Where are you?

9 Q. I'm in column 2 on page 160.

10 A. Okay. I'm with you.

11 Q. Right. And do you see that Chokkaram is
12 describing the precipitate as including aluminum
13 trihydroxide and cobalt dihydroxide?

14 A. Yes.

15 Q. And so would a POSITA reviewing Chokkaram
16 understand that it was those species that were
17 forming the crystalline lattice that's reported at
18 figure 3 and also table 1?

19 A. Yes, but we do not know the ratio of
20 aluminum hydroxide to cobalt hydroxide.

21 Q. Right. Well, we know that the crystalline
22 material that's reported states that they're

1 present in a ratio of one atom of cobalt every two
2 atoms of aluminum, right?

3 **A. In the crystal, yes.**

4 Q. Yeah. And there's also some reports -- I
5 guess it's not given, but there's also a report --
6 if we turn back to the experimental section of --
7 in addition to the aluminum being doped with cobalt
8 or nickel -- I shouldn't say doped. Being cobalt
9 and nickel illuminate -- strike that.

10 In addition to the cobalt and nickel
11 illuminate samples there's also a report of the
12 preparation of alumina in the paragraph below that;
13 do you see that?

14 **A. Yes.**

15 Q. And it says that alumina was prepared from
16 an aqueous aluminum nitrate solution; do you see
17 that?

18 **A. Yes.**

19 Q. And then it was calcined for four hours in
20 air at temperatures from 200 degrees Celsius or
21 centigrade to 900 degrees Celsius?

22 **A. Yes.**

1 Q. And so calcination in the context of
2 Chokkaram, is it fair to say a POSITA reviewing
3 this would understand that this calcination is
4 being used to form a crystalline lattice?

5 A. Yes, but we don't know if this crystalline
6 lattice is homogeneous or if it's existing in the
7 presence of excess alumina oxide.

8 Q. Right. Well, we know from the XRD that
9 the major peaks in figure 3 all correlate to cobalt
10 aluminate, right?

11 A. Yes.

12 Q. So would a POSITA understand that the
13 major species present in the crystalline lattice is
14 cobalt aluminate?

15 A. In the absence of other information the
16 POSITA would understand that the cobalt species is
17 that form.

18 Q. Right. And there's no report of any other
19 species being present in the lattice, right?

20 A. There's no report.

21 Q. Right. And so if there was another major
22 species present, wouldn't you expect that to be

1 reported and be seen in the XRD spectrum?

2 **A. I don't know if gamma-alumina by itself,**
3 **what that looks like on XRD.**

4 Q. Right. And you haven't done any XRD, have
5 you?

6 **A. I've not done XRD. I've watched it done,**
7 **but I haven't done it myself.**

8 Q. Would you expect that a POSITA in the
9 context of developing catalyst would have
10 experience with XRD?

11 **A. Probably not.**

12 Q. Okay. So turning back to the calcination
13 here, Chokkaram doesn't discuss any subsequent
14 chemical treatments of these catalysts, does it?

15 **A. After calcination?**

16 Q. After calcination.

17 **A. I don't think so.**

18 Q. Okay.

19 And generally speaking, commercial --
20 commercially available gamma-alumina is necessarily
21 calcined in order to make the gamma phase of the
22 alumina, correct?

1 **A. It might be helpful to turn to table 3 and**
2 **table 4.**

3 Q. We'll get there in a second. Let's turn
4 back to my question first.

5 **A. I'm sorry.**

6 Q. So gamma-alumina, commercially available
7 gamma-alumina, in order to prepare the gamma phase
8 of the alumina it's necessarily calcined, correct?

9 **A. I don't know.**

10 Q. Well, if you make alumina from a
11 precipitation reaction as is done in Chokkaram, in
12 order to make the gamma-alumina phase you would
13 have to calcine it, correct?

14 **A. Chokkaram certainly reports calcination of**
15 **the alumina.**

16 Q. Is there another way that you're aware of
17 to make gamma-alumina other than through
18 calcination?

19 **A. I have not studied that.**

20 Q. Would you agree that a POSITA would
21 understand that the most common way to make
22 gamma-alumina is through calcination?

1 **A. A POSITA would understand the most common**
2 **way to acquire gamma-alumina is to purchase it.**

3 Q. Right.

4 **A. And so --**

5 Q. My question is --

6 **A. -- a POSITA might not be motivated to**
7 **inquire how it's made.**

8 Q. My question is, Doctor, we looked at
9 literature that you cited in your first report that
10 talked about precipitating aluminum hydroxide --

11 **A. Yes.**

12 Q. -- and than calcining it --

13 **A. Yes.**

14 THE REPORTER: One at a time, please.

15 Q. -- to make gamma-alumina. Do you remember
16 that?

17 **A. Yes.**

18 Q. And this is also reporting the preparation
19 of gamma-alumina through a similar precipitation
20 and then calcination, correct?

21 **A. Yes.**

22 Q. And so calcination is required by

1 Chokkaram to prepare the catalyst; is that fair?

2 **A. Gamma-alumina, say it's prepared by**
3 **calcination, does not necessarily make a good**
4 **catalyst.**

5 Q. Let's turn back to my question, which is
6 Chokkaram describes all of the catalysts that are
7 prepared here required calcination, correct?

8 **A. All the catalysts in Chokkaram are**
9 **calcined.**

10 Q. And that calcination as Chokkaram reports
11 is designed to form a crystalline material, right?

12 **A. I expect one could describe gamma-alumina**
13 **as crystalline in the sense that it's ordered.**

14 Q. And so in order to form that ordered or
15 crystalline material Chokkaram describes
16 calcination as being the method that's done, right?

17 **A. Chokkaram at varying temperatures calcines**
18 **the alumina.**

19 Q. As well as the other two catalysts that --

20 **A. Yes.**

21 Q. -- are the cobalt- and nickel-alumina,
22 right?

1 **A. Yes.**

2 Q. And I think when we talked about Takamura,
3 calcination in that context was done after a
4 chemical treatment; is that right?

5 **A. Yes.**

6 Q. So the question is for you, Doctor, why
7 would a POSITA look to Chokkaram as -- which
8 discusses the formulation of a crystalline lattice
9 as being relevant to the calcination of something
10 that's already crystalline but now being treated
11 with a chemical treatment such as, in the context
12 of Takamura, sulfuric acid?

13 **A. Takamura teaches the importance of**
14 **calcination after treatment.**

15 Q. Right.

16 **A. Even though the gamma-alumina is a product**
17 **of calcination, after it's treated it must be**
18 **calcined. The Chokkaram teaches the appropriate**
19 **temperatures for calcination and has physical**
20 **evidence for BET of the -- at different**
21 **temperatures. The table 3 and table 4 of Takamura**
22 **there's again an example -- there's data about**

1 **calcination temperature. And so with table 3 the**
2 **calcine is 673 degrees, table 4 calcine 1173.**
3 **These are degrees K. And so we're talking about**
4 **400 versus 900 calcination. And the -- clearly**
5 **teaching that the 673 K calcination if we look at**
6 **conversion, for instance, the conversion is better**
7 **for the 673 K calcination than the 1173**
8 **calcination.**

9 Q. Right. And I guess the question I have is
10 this is speaking to changes in the crystalline
11 lattice of alumina calcined at 400 C versus 900 C,
12 right?

13 A. Yes.

14 Q. And what I'd like to know is how is that
15 at all relevant to an alumina catalyst that has
16 been chemically treated and then calcined because
17 wouldn't a POSITA view those as being fundamentally
18 two different processes?

19 A. The POSITA is seeking instructions on how
20 to prepare an active, effective gamma-alumina
21 catalyst. Takamura teaches treatment followed by
22 calcination at a particular time and temperature.

1 Chokkaram has two different sources of catalysts
2 that they prepare. One has cobalt or nickel in
3 large quantities, far more than what we've talked
4 about with just treatment with an activator or
5 passivator if you prefer. And so we have this
6 whole range of Takamura with a small -- little bit,
7 Chokkaram with none, and Chokkaram with a lot.

8 Q. And when you say --

9 A. And every one of those teaches a
10 calcination temperature that works and they're all
11 the same temperature.

12 Q. Right, which in this case is what,
13 400 degrees Celsius?

14 A. 400 to 500, that sort of range, yeah.

15 Q. Okay.

16 A. As opposed to not 900, not 300.

17 Q. Are you aware of any literature that
18 describes a calcination at a temperature as high as
19 900 degrees C for a chemically treated catalyst?

20 A. I've not looked for such literature.
21 Everything I have read teaches a lower temperature
22 for calcination to make an active catalyst. That's

1 **understandable based on Chokkaram.**

2 Q. Right. And I think Dr. Wright testified
3 that calcination is generally carried out as a
4 temperature range of 200 to 600 degrees C. Do you
5 remember seeing that?

6 A. I do remember seeing that. The evidence
7 is much more in the 400 to 550 range to be
8 effective calcination.

9 Q. Okay. And why is that?

10 A. That's just what Takamura says, that's
11 what Chokkaram says, and many others.

12 Q. Okay. Well, I think we agreed that
13 Chokkaram's disclosure here of the very high
14 temperatures, a POSITA wouldn't even really look at
15 that as being relevant, right, to calcination of a
16 chemically treated catalyst?

17 A. It would teach not to do it.

18 Q. Well, Chokkaram's calcination was done for
19 a different purpose, which was to study changes in
20 the fundamental crystalline lattice and the effect
21 that calcination can have on that, right?

22 A. No. Table 3 and table 4 is just alumina.

1 **And so we have alumina with no additives being**
 2 **calcined in that range. We have alumina with an**
 3 **additive in Takamura being calcined at that range.**
 4 **Then we have alumina with a lot of other metal in**
 5 **it being calcined at that range. It's all coming**
 6 **out the same.**

7 Q. Right. We're talking about the conversion
 8 of 2-octanol in Chokkaram, right?

9 **A. Yes.**

10 Q. And Chokkaram's reporting conversion in
 11 table 3 as high as 97.4 percent, right?

12 **A. Yes.**

13 Q. But is reporting a wide distribution of
 14 different octenes, correct?

15 **A. No.**

16 Q. Well, we've got 1-octene, we've got
 17 cis-2-octene, trans-2-octene, and then we have 3-
 18 and 4-octene; do you see that?

19 **A. Yes. We started with 2-octanol.**

20 Q. Right.

21 **A. And so, of course, we expect both**
 22 **1-octene, cis-2-octene, and trans-2-octene. So**

1 that's not a scatter at all, that's exactly what we
2 expect. The question is how much -- you know, the
3 POSITA would -- dehydrating 1-octanol is concerned
4 about conversion to 1-octene but is also concerned
5 about further isomerization. And so a POSITA would
6 be motivated to look at the other column how much 3
7 and 4 there was, and with 97.4 percent conversion
8 there's only 7/10ths of a percent of alkene
9 migration. So that looks pretty good.

10 Q. Well, there could be migration between 1-
11 and 2-octene as well, correct?

12 A. If migration is going on, it would be
13 expected that 3 and 4 would start to show up.

14 Q. Well, if you're forming 1-octene, the
15 thermodynamically more stable octene is the
16 2-octene, correct?

17 A. Of the three the most stable is the
18 trans-2-octene. Between the cis-2-octene and the
19 1-octene, I'd have to look that up. They're
20 probably pretty similar.

21 Q. Right. And there's no way of knowing
22 based on this data here to what extent 1-octene is

1 forming initially versus the 2-octene, right?

2 **A. Based on this data, I expect that these**
3 **are all kinetic products. And so kinetically the**
4 **2-octanol is making the cis-2-octene. If that**
5 **product were equilibrating, it would be massively**
6 **in the direction or substantially in the direction**
7 **of the trans-2-octene. So we conclude that we're**
8 **making kinetic products and that the ratios in this**
9 **particular line, which is one, two, three, four,**
10 **five, six, seven down -- sorry -- six down, that**
11 **these numbers are kinetic products.**

12 **Q. Right. And based on these numbers would a**
13 **POSITA expect -- what regioselectivity of 1-octene**
14 **from 1-octanol would you expect or would a POSITA**
15 **expect from this data for this catalyst?**

16 **A. The initial dehydration is 100 percent**
17 **1-octene. The 2-octene comes from alkene migration**
18 **after the dehydration. And the POSITA would then**
19 **look at how much 3 and 4 there is and observe**
20 **there's not very much, not very much migration**
21 **going on.**

22 **Q. Right. And your -- it's your testimony**

1 that a POSITA would be able to make that inference
2 for 1 -- for the dehydration of 1-octanol --

3 **A. Yes.**

4 Q. -- based on this data from 2-octanol?

5 **A. Yes.**

6 Q. And mind you this is a POSITA who has an
7 undergraduate degree in chemical engineering or
8 chemistry and two years' experience?

9 **A. Yes.**

10 Q. Why is that?

11 **A. The POSITA would understand very clearly**
12 **that 2-octanol can become either 1-octene or**
13 **2-octene. The appearance of 1-octene and 2-octene**
14 **would not be a surprise. They would also know that**
15 **if any migration went on, then you could start to**
16 **see 3-octene and 4-octene. And so the POSITA would**
17 **be motivated to look how much 3- and 4-octene there**
18 **was.**

19 Q. Okay. So based on Chokkaram, why would a
20 POSITA be motivated to use a chemically modified
21 catalyst?

22 **A. I don't know that we have any experimental**

1 conditions for how long Chokkaram ran the
2 reactions, but a POSITA might be motivated by long
3 run times.

4 Q. Okay.

5 A. We don't know -- our POSITA is a
6 hypothetical construct. We don't know what their
7 instructions are for dehydrating the 1-octanol.

8 Q. Is --

9 A. We don't know what yield they need, we
10 don't know what quantities they're talking about,
11 we don't know what run times they need. And so
12 thinking about the motivation of the POSITA in the
13 absence of those instructions, it's a little
14 difficult.

15 Q. Okay. Is it fair to say that a POSITA
16 would also -- would always want to optimize the
17 yield of the desired product?

18 A. Again, our POSITA is a hypothetical
19 construct and we don't know their instructions, but
20 the POSITA is motivated to achieve whatever those
21 instructions are. He needs -- the POSITA needs
22 sufficient success, but whether 97.5 is required

1 **versus 96.4, we don't know.**

2 Q. Okay. I think we talked a little bit
3 earlier about conversion, regioselectivity, and you
4 just also mentioned something I think related to
5 the amount of time that a catalyst can be used
6 under certain conditions to give a specific
7 conversion and regioselectivity, right?

8 A. **Yes.**

9 Q. And I think Dr. Wright referred to that as
10 time on stream?

11 A. **Yes.**

12 Q. A POSITA working at a chemical company who
13 is selecting a catalyst would be motivated by
14 having a longer time on stream for a catalyst,
15 right?

16 A. **I don't know. I don't know what the**
17 **POSITA's instructions are.**

18 Q. Well, is it fair to say these catalysts
19 aren't cheap, right?

20 A. **Gamma-alumina is very cheap.**

21 Q. Okay. But a catalyst that's been modified
22 chemically, calcined, you're spending a pretty

1 significant amount of time and effort to do those
2 steps, especially on an industrial scale, right?

3 **A. We don't know what scale the POSITA has**
4 **been instructed to work on.**

5 Q. Right. So is it your testimony that a
6 POSITA could be doing things on a very small gram
7 scale?

8 **A. We don't know.**

9 Q. Well, what's your -- what is your POSITA?
10 It's a person of ordinary skill in the art. In the
11 context of an industrial chemical operation they're
12 typically talking about multiple tons of product,
13 right?

14 **A. We don't know on what scale the POSITA is**
15 **working. If we want to create a hypothetical**
16 **construct of a certain number of metric tons per**
17 **week, we could talk about what would be needed, but**
18 **we don't know that's what the POSITA needs.**

19 Q. Okay. If that's the case, if that's the
20 case, then why would the POSITA be motivated to
21 improve the regioselectivity or conversion at all
22 for any of these catalysts?

1 A. Presumably the POSITA needs to make a
2 certain amount of 1-octene and so the POSITA also
3 does not want to waste time. So the POSITA would
4 be motivated to learn how to make an effective
5 catalyst on whatever scale was needed, build the
6 reactor, probably not an open flask because of the
7 volatility of the products, and run the reaction to
8 whatever scale was necessary, but having first been
9 motivated to make a catalyst that gave sufficient
10 regioselectivity and yield, conversion, all those
11 things to make an acceptable supply of the desired
12 1-octene.

13 Q. Right. And in the context of a POSITA at
14 a chemical company who's been tasked with this
15 would time on stream also be a factor in selecting
16 a catalyst?

17 A. It might be. We don't know.

18 Q. Would a POSITA presented with two
19 different catalysts, one of which is disclosed as
20 working for, say, six months and the other catalyst
21 knowing it's only going to work for one month,
22 which catalyst would the POSITA select?

1 A. The POSITA will work according to their
2 instructions. It may be that they only need enough
3 1-octene that they can do it all in a single shot
4 in one day and be done. Compared to the time of
5 the POSITA at typical current wages, gamma-alumina
6 is very cheap. And so is 1-octanol.

7 Q. Right. So it's your testimony that time
8 on stream may not be relevant to selecting a
9 catalyst?

10 A. It may, it may not.

11 Q. Would it -- is it fair to say that some of
12 the prior art that you identified in your analysis
13 speaks to time on stream as being an important
14 factor in selecting a catalyst?

15 A. Certainly on the metric ton scale time on
16 stream is very important. If you read the De Bruyn
17 patent, they speak of the results after a single
18 pass and then go on and talk about the net results
19 recycling the -- pulling off the 1-octene product
20 and recycling the mixture of alcohols and ethers
21 back onto the catalyst. And so for them time on
22 stream is very important.

1 Q. Okay. In the context of conversion is it
2 fair to say that recycling is one method to improve
3 conversion for catalysts that give lower
4 conversions?

5 A. Alkene migration is inherently a
6 subsequent step. And so if a catalyst will give
7 clean 1-alkene and only convert half the alcohol or
8 even maybe convert most of the alcohol but half of
9 it is ether, that's fine. Just pull off the sweet,
10 clean alkene --

11 Q. And recycle the starting materials?

12 A. -- and recycle the rest. And you can
13 still measure yield because you know how much
14 alcohol went in to this continuing run and you know
15 how much alkene came out.

16 Q. In other contexts would it -- could it be
17 desirable to -- or could it be necessary for a
18 POSITA to run a process that provided high yield
19 with a single pass?

20 A. Again, we don't know the POSITA's
21 instructions. If they're working on a lab scale,
22 you know, maybe even up to kilos, they might be

1 motivated to make -- treat a bunch of
2 gamma-alumina, put it all in a column, and run
3 through a few kilos of 1-octanol in a single pass
4 and pull out their 1-octene and be done.

5 Q. Right. Even on a larger scale could it
6 also be relevant to have a high yield with a single
7 pass?

8 A. We'd need high conversion and high yield
9 of the desired alkene, desired alkene, meaning
10 minimal migration. And one can imagine that if
11 you're doing a single pass you want all those
12 things.

13 Q. All right.

14 Let's -- you have your second declaration
15 open there, Doctor. I've got a few questions. I
16 think we're at page 7.

17 A. Yep.

18 Q. Do you see at the bottom of page 7 there
19 there's -- underneath the header Roman numeral 3,
20 "Summary of my opinions," there's a list of grounds
21 1 through 5; do you see that?

22 A. Yes.

1 Q. Did you develop these grounds yourself or
2 were these provided to you by counsel?

3 **A. We consulted about them together. They're**
4 **mostly written by counsel.**

5 Q. Okay. So the first is "No written
6 description support"; do you see that?

7 **A. I'm sorry. Where are you?**

8 Q. In ground 1, table -- sorry. Turn back a
9 page.

10 **A. Okay.**

11 Q. There you go.

12 **A. All right.**

13 Q. I'm still in the table on page 7. So the
14 first one is "No written description support"; do
15 you see that?

16 **A. Yes.**

17 Q. The second one is 103, "Le in view of
18 De Bruyn"; do you see that?

19 **A. Yes.**

20 Q. Now, I believe in your first declaration
21 you had Le by itself or optionally in view of
22 De Bruyn. Do you remember that?

1 **A. I'd have to look at the declaration.**

2 Q. Okay. Your opinions here, though, just
3 pertain to Le in view of De Bruyn as one of the
4 grounds, right?

5 **A. Yes.**

6 Q. You also have ground 3 listed as
7 Wright 788; do you see that?

8 **A. Yes.**

9 Q. And the basis again is 103 or obviousness,
10 right?

11 **A. Yes.**

12 Q. You don't have Wright in view of any other
13 prior art references, correct?

14 **A. As written here, no. Of course, there's a**
15 **great deal of art before Wright, including**
16 **Wright 788.**

17 Q. Right. And just to be clear, Wright 451,
18 ground 4, is -- is a separate ground for 103,
19 correct?

20 **A. Yes.**

21 Q. And here and in your declaration you don't
22 actually combine Wright 788 and Wright 451 in an

1 obviousness combination, correct?

2 **A. We do not combine them. In his deposition**
3 **Dr. Wright certainly addressed them both.**

4 Q. Okay. But in your -- in your opinions
5 that you have in this case you don't combine those
6 two references, right?

7 **A. We do not formally combine them, no.**

8 Q. Okay.

9 And your final ground 5 is Wu, W-U, in
10 view of Chokkaram, correct?

11 **A. Yes.**

12 Q. That's also obviousness under 103?

13 **A. Yes.**

14 Q. And I think if we turn to the next page,
15 "Legal principles," paragraphs 9 and 10 discuss
16 anticipation; do you see that?

17 **A. Yes.**

18 Q. Do you actually have any opinions
19 concerning anticipation in this declaration?

20 **A. Anticipation can be many things. If we**
21 **take it as meaning that it's already written**
22 **somewhere else, then yes.**

1 Q. Well, what's your understanding of
2 anticipation?

3 **A. That's my understanding is that it was**
4 **already described previously in the same way.**

5 Q. Right. Basically the same invention --

6 **A. Yeah.**

7 Q. -- was described in the prior art; is that
8 right?

9 **A. Yes.**

10 Q. In the same manner it's described in a
11 later claim; is that fair?

12 **A. A later claim?**

13 Q. So a claim at issue.

14 **A. Yes.**

15 Q. Okay.

16 But if we look back at table -- the table
17 at paragraph 6 of your declaration, anticipation
18 isn't listed as a ground or a basis, correct?

19 **A. I don't understand the question.**

20 Q. So you talk about anticipation on page 8,
21 but if we look back at the table, there's no ground
22 that describes anticipation, correct?

1 **A. Is anticipation a different basis number?**

2 Q. Well, I don't see it listed as any of the
3 basis numbers there.

4 **A. I'm not understand- -- I'm not following**
5 **the question.**

6 Q. So if we look at this table underneath
7 paragraph 6, there's grounds 1 through 5 and the
8 statutory basis. Anticipation's not listed there,
9 correct?

10 **A. I don't know how anticipation would be**
11 **listed if it were listed. How would it be listed?**

12 Q. Would it be listed as section 102? Are
13 you familiar with that?

14 **A. No.**

15 Q. So what is your opinion as to
16 anticipation? Are -- in your opinion are any of
17 the challenged claims 29 through 44 anticipated?

18 **A. 29 through 44, let's turn to those. Can**
19 **we have that?**

20 Q. No. What I want to ask you about is
21 whether your opinions contained in the second
22 declaration include the anticipation of any of the

1 claims. You looked at your declaration yesterday
2 in preparation for this, right?

3 **A. Yes, and I also looked at the amended**
4 **claims, but if I'm going to speak about the amended**
5 **claims I need to have them in front of me.**

6 Q. Well, what I'd like to find out, Doctor,
7 is where in your second declaration are any of the
8 claims or your opinions described as anticipation
9 being a basis for invalidity.

10 **A. If we could speak to the specif- -- to the**
11 **amended claims I'd like to do that but -- if that's**
12 **what you're asking.**

13 Q. I'm just asking if you have any opinions
14 that involve anticipation, Doctor. It's a pretty
15 simple question.

16 **A. I understand it's important to you. I'm**
17 **not sure I understand all the ramifications of it.**

18 MR. LUKAS: Feel free to instruct
19 Dr. Taber if you'd like to speak on the record,
20 Mr. Murphy.

21 THE WITNESS: If it's not here it's not
22 here.

1 MR. MURPHY: If we turn to the next page,
2 we rely on obvious under 103.

3 THE WITNESS: Okay. Yeah.

4 MR. MURPHY: So we list 103 as the ground
5 for the rejection.

6 THE WITNESS: I don't know what this
7 mythical 102 is, but anyway we can stay with 103
8 apparently.

9 BY MR. LUKAS:

10 Q. Simply another part of the statute --

11 **A. All right.**

12 Q. -- the patent statute, Doctor.

13 THE REPORTER: Guys, let's go one at a
14 time.

15 BY MR. LUKAS:

16 Q. So based on the presence or the
17 description of section 103 in paragraph 11 of your
18 second declaration, is it your opinion that that's
19 the statutory basis for invalidity described in
20 this declaration?

21 **A. Yes.**

22 Q. Okay. As far as you know, you're not --

1 you don't have any opinions under what we're going
2 to call section 102?

3 **A. I don't even know what section 102 is.**

4 Q. Okay. I wanted to turn to page 11 of your
5 report. So at paragraph 20 there's a discussion
6 about different terms and what they mean; do you
7 see that?

8 **A. Yes.**

9 Q. The first one is calcined?

10 **A. Yes.**

11 Q. And I think here you say that calcined
12 should be interpreted as "Sufficient heating to
13 complete the chemical change to the catalyst,"
14 right?

15 **A. Yes.**

16 Q. And in this context does chemical change
17 refer to a chemical treatment of an alumina
18 catalyst?

19 **A. The chemical treatment is separate from
20 the calcination. First you treat the gamma-alumina
21 and then calcine that, dry it and then calcine it.**

22 Q. Okay. So let me -- if we -- when we

1 looked at Chokkaram we saw calcination temperature,
2 affected surface area, pore size, things of that
3 nature; do you recall that?

4 **A. Surface area, yes.**

5 Q. Right. Was that -- in your opinion would
6 those changes that we saw in Chokkaram be a
7 chemical change as you describe here at
8 paragraph 20?

9 **A. That was the change I was referring to,**
10 **the change in structure. We can call it a chemical**
11 **change. It's sort of a broad -- chemical change is**
12 **sort of a broad term, but the -- I think it's a**
13 **sufficient and accurate term for what's happening**
14 **to the catalyst, to the gamma-alumina.**

15 Q. Well, Chokkaram didn't actually describe
16 any chemical changes that were occurring in those
17 catalysts or at least in the alumina catalyst,
18 correct?

19 **A. Any change in bonding or arrangement of**
20 **atoms is a chemical change.**

21 Q. Okay. So is it your testimony that
22 chemical change doesn't require a change in

1 chemical composition? It could include a change in
2 chemical bonding?

3 **A. Yes. The difference between graphite and**
4 **a diamond is a difference in chemical bonding, how**
5 **atoms are structured, but it's not a difference in**
6 **chemical composition. It's all pure carbon.**

7 Q. Right. And so I just want to make sure I
8 understand what -- the definition of calcination
9 that we're operating under, what --

10 **A. Sure.**

11 Q. -- that entails, and in this context it's
12 really any change in chemical bonding; is that
13 right?

14 **A. Yes.**

15 Q. And so in the context of a chemical
16 treatment to a gamma-alumina catalyst that is then
17 calcined, it's not required that -- would it be
18 fair to say it's not required that the catalyst
19 actually incorporates any material from the
20 chemical treatment? And maybe that is an inelegant
21 question.

22 So if a chemical treatment of a

1 gamma-alumina catalyst didn't result in any new
2 atoms in the catalyst, that could still be viewed
3 as a -- but changed the chemical bonding of the
4 catalyst, that could still be viewed as a "chemical
5 change"; is that fair?

6 **A. Yes.**

7 Q. And so, you know, one of the things -- the
8 next definition is silanized, right, in your
9 report?

10 **A. Yes.**

11 Q. And we talk about silanization requiring
12 an affirmative step in catalyst preparation, right?

13 **A. Yes.**

14 Q. So in other words, it actually requires
15 the introduction of additional chemical species to
16 the alumina catalyst, right?

17 **A. Yes.**

18 Q. I think there's also the term "base
19 treated" is used?

20 **A. Yes.**

21 Q. What does base treated mean?

22 **A. In the context of the catalyst preparation**

1 **base treatment is the addition of usually an**
2 **aqueous solution of an alkaline salt.**

3 Q. Okay. And that's typically an alkaline
4 metal salt or an alkaline earth metal salt?

5 A. **Most of the examples are alkaline and**
6 **alkaline earth. There are many others.**

7 Q. Okay. What else is there in terms of
8 bases that people would typically use to treat
9 gamma-alumina?

10 A. **In the patent information there's -- many**
11 **are mentioned, but usually the ones that are**
12 **actually used most often that I have seen are**
13 **sodium, potassium, calcium, magnesium, barium --**

14 THE REPORTER: I'm sorry. Sodium --

15 THE WITNESS: -- calcium, magnesium,
16 barium, calcium -- sodium, potassium, magnesium,
17 barium, calcium.

18 Q. All right. I'm going to hand you what's
19 been previously marked as Exhibit 1025, this is
20 the Wu reference, W-U.

21 A. **Thank you.**

22 Q. And it's U.S. Patent No. 4,234,752. So I

1 believe Wu describes the base treatment of
2 gamma-alumina; is that fair?

3 **A. Yes.**

4 Q. And if you look at column 2 beginning
5 around line 23.

6 **A. Yes.**

7 Q. It discusses the use of a base, an aqueous
8 base, which is given as potassium hydroxide or
9 sodium hydroxide --

10 **A. Yes.**

11 Q. -- as being used to I guess neutralize or
12 remove what are referred to as acidic sites on the
13 catalyst, right?

14 **A. Yes.**

15 Q. Would a POSITA reviewing Wu understand or
16 know that sodium or potassium is being incorporated
17 into the alumina?

18 **A. No.**

19 Q. What is your understanding of what a
20 POSITA would understand about that chemical
21 reaction that's described in Wu, column 2?

22 **A. In some patents they talk about analysis**

1 of the bulk treated catalyst after calcination and
2 demonstrate that there is still residual, for
3 instance, calcium there. There's no such evidence
4 in Wu. That does not mean it's not there, but
5 there's no affirmative evidence that it is there.

6 Q. Right. What would a POSITA understand as
7 far as whether it's there or not based on the
8 chemical reaction, or would a POSITA simply not
9 know?

10 A. A POSITA would not be motivated to find
11 out. They would just know this works, this is a
12 good way to make a catalyst, and press on.

13 Q. Okay. Now, Wu doesn't describe
14 calcination after the base treatment, right? He's
15 just describing drying?

16 A. That is correct.

17 Q. Why is that?

18 A. I do not know why Wu does not include
19 calcination in the description. I can speculate
20 that -- if you wish, that Wu is so familiar with
21 catalyst preparation that he doesn't think it's
22 worth mentioning that he calcined afterwards.

1 **That's why we need detailed references like**
2 **Takamura and Chokkaram where they really do speak**
3 **precisely to how they made their active catalyst.**

4 Q. So is it your testimony that Wu actually
5 does calcine but doesn't say that after base
6 treatment?

7 A. **It is my expectation that these catalysts**
8 **were calcined.**

9 Q. After treatment with a base?

10 A. **After base treatment.**

11 Q. And would that be a POSITA's expectation
12 as well?

13 A. **Yes.**

14 Q. Why is that?

15 A. **Because wherever there are truly detailed**
16 **descriptions of how to prepare an active catalyst,**
17 **every one of those is calcined. Now, you could, of**
18 **course, think that if we look at Chokkaram**
19 **calcination, you know, the chemical changes, the**
20 **change in surface area might start around**
21 **300 degrees. They're running their reactor at 350**
22 **and maybe that's sufficient -- they heat it up and**

1 **keep it hot for a while, that's sufficient to**
2 **calcine the catalyst, to effect the chemical change**
3 **of the catalyst, sufficient to make an active**
4 **catalyst.**

5 Q. So if a particular catalyst temperature
6 had been used by Wu to calcine, don't you think
7 that would have been important information to
8 include in Wu?

9 A. We do not know if Wu used a separate
10 calcination step, but the use of a separate
11 calcination step is so common in the field, Wu
12 might have done that -- it's only a speculation.
13 Wu might have done that and not mentioned it. Wu
14 might have known that at 350 degrees there's
15 already significant calcination going on and why
16 bother, just try it and see if it works. So we
17 don't know. That's all speculation. We do know
18 that Wu does not specifically mention a separate
19 calcination step.

20 Q. Okay. So if we look at -- so first of
21 all, just to talk about the bases, so we have
22 sodium hydroxide and potassium hydroxide

1 specifically disclosed by Wu, right?

2 **A. Yes. In a particular example, example**
3 **Roman numeral 2, is potassium hydroxide.**

4 Q. Right. Would a POSITA expect that other
5 bases would work in a similar manner?

6 **A. If we could just pause on the previous**
7 **question. The -- Wu is very precise by using**
8 **30 grams and 7.6 liters of water -- oh, here we**
9 **are. He does say how much gamma-alumina. I was**
10 **missing that. 11.4 kilos of gamma-alumina. I'm**
11 **sorry.**

12 **What was your other question?**

13 Q. My question was Wu describes sodium
14 hydroxide, potassium hydroxide, but no other bases,
15 right?

16 **A. That's correct.**

17 Q. Would a POSITA expect similar results
18 could be obtained as described in Wu using other
19 bases?

20 **A. From Wu only the POSITA would have no**
21 **information. From other literature that they have**
22 **read there are many other additives that are**

1 **possible.**

2 Q. So I'm just asking Wu --

3 **A. From Wu --**

4 Q. From Wu, POSITA's reviewing Wu --

5 **A. Wu was --**

6 THE REPORTER: Guys, we gotta go one at a
7 time.

8 Q. Sorry. POSITA's reviewing -- I know
9 you're with me if you want to nod, go ahead, or ask
10 me to ask a better question. Withdrawn.

11 So a POSITA reviewing Wu which discloses
12 sodium hydroxide, potassium hydroxide, would a
13 POSITA expect, based on Wu's disclosure, that
14 similar results could be obtained with other bases?

15 **A. The POSITA would not know.**

16 Q. And is that because whether other bases
17 would or would not work is unpredictable?

18 **A. The only information that the POSITA has**
19 **from Wu is the importance of sodium hydroxide or**
20 **potassium hydroxide, but Wu particularly uses**
21 **potassium hydroxide, not sodium, to maintain high**
22 **selectivity and high conversion with this catalyst.**

1 **So...**

2 Q. Right. So just stopping there, if we look
3 at example 1 in Wu, we have an untreated catalyst,
4 correct, in other words, a catalyst that has not
5 been treated with a base?

6 A. That's apparently the case, yes.

7 Q. And if we look at the table, there's run
8 No. 1, which I believe is the invention, INV, and
9 then we have run No. 2, which is comparative or
10 COMP; do you see that?

11 A. Yes. This makes me think that when they
12 speak of gamma-alumina in example 1 they're
13 referring to both.

14 Q. Well, the difference that I see --

15 A. And that then in table 1, the table,
16 they've spoken of both kinds. They've spoken about
17 the treated gamma-alumina and the untreated
18 gamma-alumina. The treated gamma-alumina is the
19 invention. And so one can -- my conclusion reading
20 table 1 -- the table, I'm sorry, is that the
21 invention gives good yield in selectivity and
22 conversion, and the comp here, presumably

1 **comparable or comparative, is the gamma-alumina**
 2 **that is not -- was not base treated.**

3 Q. Well, example 2, Roman numeral 2, actually
 4 discloses gamma-alumina with base treatment.
 5 Example 1 makes no mention of any base treatment,
 6 correct?

7 A. It talks about the presence or absence of
 8 nitrogen.

9 Q. Right. So table is highlighting the
 10 difference between gamma-alumina that has not been
 11 base treated and the use of a nitrogen carrier,
 12 right?

13 A. Not necessarily. It may be that example 1
 14 is talking about their gamma-alumina that they've
 15 treated with base.

16 Q. Well, that's not what it says, is it?

17 A. We don't know because they talk about --
 18 in column 2, as you recall, they talk about
 19 treatment with, you know, base washing. And so now
 20 we have -- so they've done that, they have their
 21 base-washed gamma-alumina. Now, they have two
 22 examples here. In the first one they're looking at

1 the effect of the nitrogen flow rate, this is
2 inventive run 1. Now, inventive -- comparative
3 run 2 employed no nitrogen, but nowhere here does
4 this say whether or not the gamma-alumina they used
5 in these two runs was base treated. In example 2
6 they talk in further detail about large-scale
7 preparation of -- well, 11.4 kilos of gamma-alumina
8 and running the reaction. The -- we've just not
9 followed the gamma-alumina in example 1 was not
10 base treated.

11 Q. Right. So I believe it was your testimony
12 that in example 1 of Wu the lack of disclosure
13 concerning base treatment would indicate to a
14 POSITA that no base treatment was done for the
15 catalyst used in example 1, correct?

16 A. No, that is not correct.

17 Q. So it's your testimony that Wu is
18 disclosing an example that -- in which base
19 treatment was performed but that's not what the
20 document says, correct?

21 A. The document has no information about
22 whether or not the gamma-alumina in example 1 was

1 base treated. They talk about the importance of
2 base treatment in example 2 when they scale up the
3 reaction. Remember, example 1 is 24.8 grams of
4 gamma-alumina. Example 2 is 11.4 kilos of
5 gamma-alumina. And so example 1 looks to me like a
6 test run of the gamma-alumina that they like to
7 find out whether or not it's important to run
8 nitrogen with the alcohol to help flow rate through
9 the catalyst.

10 In example 2 they scale it up and say, ah,
11 with 11.4 kilos now we're going to measure how many
12 potassium hydroxide, how much water, and, okay,
13 that's how we made our catalyst and we scaled it up
14 and, yeah, that worked too and we were careful to
15 use a nitrogen flow as we learned in example 1.

16 Q. Okay. So I just want to be clear, Doctor.
17 It's your testimony that example 1 of Wu, even
18 though it does not disclose any base treatment and
19 even though it doesn't disclose calcination, that
20 the catalysts that were used in example 1 of Wu
21 were base treated and calcined; is that correct?

22 A. My testimony is they do not specify

1 whether or not their gamma-alumina in example 1 was
2 base treated. However, example 1 flows directly to
3 example 2 where explicitly the gamma-alumina was
4 base treated. There's every indication that
5 example 1 was used to prepare for example 2. That
6 is my testimony.

7 Q. All right. And wouldn't it be just as
8 likely that example 1 of Wu is demonstrating the
9 benefit of the use of a nitrogen carrier gas in
10 dehydration using alumina catalyst?

11 A. Example 1 certainly demonstrates the
12 importance of the nitrogen carrier gas. It is my
13 testimony that it would be both peculiar to change
14 catalysts going from the exploratory run to the
15 bulk run.

16 Q. Right. And example 2 of Wu doesn't
17 actually provide the yield or the selectivity of
18 the alkene that's produced directly off of the
19 reactor, correct?

20 A. Example 2 talks about the purity of the
21 product but does not talk about the conversion or
22 the yield.

1 Q. Right. And that --

2 A. But they do say in the next paragraph that
3 they obtained high yields and high conversion.

4 Q. Right. Well, I think what Wu says if
5 you're referring to the first full paragraph of
6 column 4, it says that "Fractional distillation of
7 the condensate gave a fraction containing
8 3-methyl-1-butene in 97.7 weight percent purity,"
9 right?

10 A. I see that.

11 Q. So they collected the product off the
12 reactor and then performed a distillation, right?

13 A. Yes.

14 Q. So there's no report of a distillation in
15 example 1, correct? They're simply collecting
16 product that comes off the reactor?

17 A. Yes, they -- that is correct. They report
18 that -- although they didn't do a distillation.
19 They just collected all the fractions coming
20 through the column and then analyzed them and they
21 saw -- they guess -- they put chromatography that
22 the first collection zone from the reactor was

1 primarily water while the lower temperature zones
2 collected the 3-methyl-1-butene. And so where they
3 talk about conversion, that means there was some
4 alcohol that was not converted. They don't talk
5 anywhere in example 1 about how they measured the
6 alcohol not converted.

7 The important paragraph I think in
8 column 4, line 15, the second full paragraph in
9 column 4, where they have distilled their product,
10 they know how much alcohol went in, they know how
11 much 3-methyl-1-butene they got, and that they
12 obtained high yields and high conversion using this
13 gamma-alumina catalyst and the inert carrier gas as
14 described.

15 And so although they have no specific
16 numbers of yield or conversion, they report high
17 yields and high conversion.

18 Q. Right. And high yield and high conversion
19 could mean different things to different people,
20 correct?

21 A. Yes. We have specific numbers in the
22 table, we look good, but the POSITA would certainly

1 **be motivated by the notice of high yields and high**
2 **conversions.**

3 Q. And we don't have any data about the time
4 on stream or the duration that these conversions or
5 yields could be obtained from these catalysts,
6 correct?

7 A. They say they're adding at the rate of
8 **11.8 liters per hour, which suggests they ran for**
9 **more than an hour, but we don't really know.**

10 Q. Right. So we don't know how long these
11 conversions or yields would continue for these
12 catalysts, correct?

13 A. We do not.

14 Q. The other thing is we have -- I believe
15 they're dehydrating 3-methyl-1-butanol, right?

16 A. Yes.

17 Q. And the preferred product that they're
18 trying to make is 3-methyl-1-butene, right?

19 A. Yes.

20 Q. What would a POSITA understand as far as
21 the dehydration of a branched alcohol versus a
22 linear alcohol?

1 **A. 3-methyl-1-butanol is not branched. The**
2 **other end of the molecule is branched. A branched**
3 **alcohol would be a secondary or tertiary alcohol.**
4 **This is a primary alcohol.**

5 Q. Right. It's a branched hydrocarbon that
6 includes an alcohol at one end?

7 **A. A alcohol -- the alcohol at one end, it's**
8 **a primary alcohol. There's no branching on**
9 **carbon 1, there's no branching on carbon 2. The**
10 **branching is on carbon 3. And so the atoms that**
11 **are involved in the dehydration do not include**
12 **branching.**

13 Q. Okay. So would a POSITA reviewing Wu,
14 just to be clear, the dehydration of
15 3-methyl-1-butanol, would you expect that to be
16 similar to the dehydration of, say, 1-N-pentanol?

17 **A. Yes.**

18 Q. No difference simply because they're
19 structural isomers and the branching is not close
20 to the alcohol, right?

21 **A. I would expect them to react essentially**
22 **the same. Now, could there be minor differences,**

1 **sure.**

2 Q. What would -- what would be a moderate
3 difference in terms of conversion or
4 regioselectivity?

5 A. **In the absence of the experiment we don't**
6 **know. I would expect and a POSITA would expect**
7 **that they would react in very similar fashion.**

8 Q. Right. Well, just looking at the -- so
9 the selectivity in table -- it's not table 1, but
10 it's the only table in Wu at column 3 for the
11 invention gives a selectivity of 96.4 percent; do
12 you see that?

13 A. **Yes.**

14 Q. And then over in column 4 there's a
15 disclosure of 97.7 weight percent purity for
16 example 2; do you see that?

17 A. **I'm sorry. Conversion 93.4.**

18 Q. Sorry. No. I'm at column 4 for
19 example 2 --

20 A. **Oh. Selectivity. Okay.**

21 Q. Sorry. Let me just ask my question,
22 Doctor.

1 So example 1 gives -- the invention of
2 example 1 gives a selectivity of 96.4. The
3 example 2 discloses 97.7 percent pure
4 3-methyl-1-butene, correct?

5 **A. I don't see where you see 97.7.**

6 Q. It's at column 4, line 13.

7 **A. Yes.**

8 Q. You see that. So I guess the question is
9 is a difference of 96.4 to 97.7, would a POSITA
10 view that as being significant?

11 **A. In the trial run there are 96.3, 96.4,**
12 **they scaled it up and went to 97.7. Great. They**
13 **would be happy about that.**

14 Q. They would be happy about increasing it by
15 1.3 to 1.4 percent?

16 **A. Yes.**

17 Q. They would be happy about that, that is
18 the answer?

19 **A. Yes.**

20 MR. LUKAS: We can go off the record.

21 (Whereupon, at 12:50 p.m., the
22 deposition was recessed, to

1 reconvene at 1:20 p.m., this
2 same day.)
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1 AFTERNOON SESSION

2 (1:23 p.m.)

3 DOUGLASS TABER, Ph.D.,

4 the witness at the time of recess, having been
5 previously duly sworn, was further examined and
6 testified as follows:

7 EXAMINATION

8 (Resumed)

9 BY MR. LUKAS:

10 Q. Doctor, we're back on the record.

11 We're still in your second declaration,
12 which is Exhibit 1038 at page 12. We were talking
13 before the break about base treatment; do you
14 remember that?

15 A. Yes.

16 Q. And I think where we landed was it could
17 be -- for base treatment it could be any base, but
18 that, generally speaking, sodium, potassium, and
19 then group 2 metals like calcium, barium would be
20 the most commonly used; is that right?

21 A. Yes. Those seem to be the most commonly
22 used.

1 Q. Okay. Now, in the prior art and I think
2 in the '048 Patent and the '803 Patent there's also
3 a discussion of promoted catalysts. Do you recall
4 seeing promoted catalysts?

5 A. Yes.

6 Q. What does a promoted catalyst refer to?

7 A. As far as I can tell, there's no
8 difference between the actual catalysts. Some are
9 called promoted, some are called modified, some are
10 called neutralized, but in each case we're treating
11 the catalyst with an alkali or alkali earth salt,
12 drying it, calcining it. We know that at least in
13 some cases these alkali or alkali earth metals are
14 included in the catalysts prepared. I don't know
15 if there's a particularly preferred term. If there
16 were, it might be promoted.

17 Q. Okay. So is it your understanding that
18 base treatment and promoted refer to the same
19 thing?

20 A. In this context, yes.

21 Q. Does a promoted catalyst require
22 incorporation of some additional element such as

1 calcium, barium, or something else to be present in
2 the catalyst or on the surface of the catalyst?

3 **A. My expectation is there usually would be**
4 **something there. I can conceive of circumstances**
5 **where that might not be true, but I don't know of**
6 **any such particularly.**

7 **Q. Okay. Circumstances where there wouldn't**
8 **be calcium or barium or some other metal present in**
9 **the catalyst; is that right?**

10 **A. Certainly there are cases with no metal**
11 **present. The sulfate of Wu, you don't think of**
12 **sulfur as a metal. So there are certain cases**
13 **where metals are not present in a promoted**
14 **catalyst, but whether there's sulfur present, we**
15 **assume so, but there's no evidence about that.**
16 **Sorry. It wasn't Wu. It was Takamura that was**
17 **sulfated.**

18 **Q. Right. So the sulfated catalyst in**
19 **Takamura, would that be considered a promoted**
20 **catalyst?**

21 **A. Yes.**

22 **Q. And the base-treated catalyst of Wu that**

1 we looked at, would that be considered a promoted
2 catalyst?

3 **A. Yes.**

4 Q. And how about the catalysts in Chokkaram
5 that we looked at that had nickel and cobalt, would
6 those be considered promoted catalysts?

7 **A. I think that the Chokkaram catalysts with
8 cobalt and with nickel are really very different.
9 They might have turned out to work well, but
10 they're -- there's a different sort of thing than
11 the promoted catalysts we've been talking about.**

12 Q. Okay. So those catalysts in Chokkaram
13 would not be considered promoted, right?

14 **A. No. Chokkaram teaches us why we use
15 certain temperatures for calcination and has, of
16 course, calcined, not promoted gamma-alumina
17 catalysts that work well.**

18 Q. Okay. And we talked a little bit about
19 Chokkaram. I wanted to turn to the next page of
20 your declaration, page 13 paragraph 25. You say
21 here that "The POSITA would know from Chokkaram
22 that optimization of the calcination temperature

1 was important"; do you see that?

2 **A. Yes.**

3 Q. And then in the next sentence or two
4 sentences there's "Chokkaram teaches that optimal
5 temperature for calcination is in the range of 673
6 to 773 Kelvin or 400 to 500 degrees Celsius." I
7 want to turn back to Chokkaram and look at that
8 with you and see exactly where in Chokkaram that
9 range of 400 to 500 C is disclosed. So where is
10 that range?

11 **A. If you turn to table 1 on page 160.**

12 Q. Okay. Table 1. Okay.

13 And so -- and we looked at table 1 before.
14 Table 1 discloses cobalt-alumina co-precipitated
15 catalyst that is calcined at 200, 300 -- sorry --
16 200, 400, 500, and 700 degrees Celsius and also 900
17 degrees Celsius, right?

18 **A. Yes.**

19 Q. And we talked about this before. This
20 is -- there's no data in Chokkaram where
21 calcination of alumina without cobalt or nickel was
22 done at these same temperatures, right?

1 A. Table 1 speaks of the cobalt case, it
2 shows optimization around 673 to 773. Table 2 with
3 nickel, it looks like the maximum began between 673
4 and 773 for the surface area. And then in table 3
5 and table 4 we have the distinction between
6 nontreated gamma-alumina being calcined at 673
7 versus 1173 where 673 is clearly superior.

8 And so one can construe from this that the
9 alumina no matter how it's treated within the range
10 of Chokkaram gives the best surface area around
11 the -- in degrees C 400, 500 degrees sort of
12 temperature.

13 Q. Okay. I wanted to turn to page 167 of
14 Chokkaram with you.

15 A. Sure.

16 Q. And at column 2 the first -- well, it's a
17 paragraph that starts on column 1 and runs over to
18 column 2. It's talking about the selectivity for
19 dehydration products shown in figure 9 and they say
20 nickel-alumina, cobalt-alumina catalysts at a
21 reaction temperature of 523 were examined; do you
22 see that?

1 **A. Yes.**

2 Q. And it says in the next sentence, "The
3 selectivity for dehydration is close to 100 percent
4 for alumina."

5 **A. Yes.**

6 Q. "And for cobalt-alumina it is 95 percent
7 or greater for calcination at 400 or 900 degrees
8 C," right?

9 **A. Yes.**

10 Q. So Chokkaram is not differentiating in
11 terms of the results for selectivity between
12 catalysts that were calcined at 400 or 900 degrees
13 Celsius, right?

14 **A. In this paragraph that is correct. Let's**
15 **go back and look at this table.**

16 Q. I'd just like to finish this paragraph
17 before we go there.

18 **A. All right.**

19 Q. You testified to the table already. And
20 it says in the next sentence the nickel-alumina
21 catalyst calcined at 400 Celsius, exhibited
22 60 percent selectivity, and this actually goes up

1 when you calcine at 900 degrees Celsius, right?

2 **A. That's what it says.**

3 Q. So you would agree, then, that Chokkaram
4 is actually saying that selectivity can increase
5 with calcination temperature, right?

6 **A. In this paragraph that's what it says.**

7 **I'm not sure this table agrees with that.**

8 Q. Turning back to your declaration at page
9 21. Sorry. It wasn't page 21. It was page 13.
10 So when you're talking about optimal calcination,
11 are you referring to optimal conversion or optimal
12 regioselectivity or something else when you're
13 talking about the optimum catalyst?

14 **A. Both are important.**

15 Q. Right. And in terms of calcination
16 temperature, what is that calcination temperature
17 affecting? Is it regioselectivity, is it
18 conversion, or is it both or something else?

19 **A. If we look at Chokkaram table 3 versus**
20 **table 4 comparing catalyst -- gamma-alumina**
21 **catalysts that was calcined at 673 K versus 1173 K,**
22 **the best conversion -- conversions, plural,**

1 **depending on reaction temperature, and -- the best**
2 **conversions are observed with 673 K calcined**
3 **material.**

4 Q. Okay. So --

5 A. The conversions are lower with the 1173 K
6 **calcined material. The selectivity is very**
7 **similar.**

8 Q. Right. So a POSITA -- and I think
9 Chokkaram says this specifically. The selectivity
10 doesn't change as a function of calcination
11 temperature, correct?

12 A. In the paragraph on page 167 you're
13 referring to the -- for just alumina the
14 conversion -- the selectivity for dehydration is
15 close to 100 percent for alumina calcined at 673.

16 Q. Or 1173 just to complete that sentence,
17 right?

18 A. No. It says that for alumina the lower
19 temperature is better. For cobalt-alumina it is
20 not a significant difference. And for
21 nickel-alumina it improves on further heating, but
22 for just gamma-alumina itself it says that it's

1 **best at the lower temperature and that's what the**
2 **table shows also, table 3 versus table 4.**

3 Q. Well, that sentence then doesn't say
4 anything about the temperature of calcination for
5 alumina in this sentence. It just says the
6 selectivity for dehydration is close to 100 percent
7 for alumina, correct?

8 A. In that paragraph it does not distinguish
9 between 673 and 1173 specifically for alumina. It
10 implies that and it certainly says that in table 3
11 and 4, but it does not specifically say that in
12 this paragraph.

13 Q. Right. And we're not -- we're not talking
14 about alumina that's been modified in any way,
15 correct?

16 A. The alumina of table 3 and table 4 is
17 gamma-alumina that's been calcined but not modified
18 before calcination.

19 Q. Right. So is it your testimony that a
20 POSITA would infer that the calcination temperature
21 for an unmodified alumina catalyst would be
22 expected to provide similar results for a

1 chemically modified alumina catalyst?

2 **A. Yes.**

3 **Q. And why is that?**

4 **A. That whatever is going on that increases**
5 **the surface area on calcination seems to be optimal**
6 **in this 400- to 500-degree range, maybe a little**
7 **higher, and specifically it's taught -- the POSITA**
8 **is taught that going significantly higher has a**
9 **deleterious effect.**

10 **Q. All right. And just to be clear, the**
11 **table you're referring to in table 1 isn't alumina**
12 **catalyst, it's actually cobalt-alumina**
13 **co-precipitated catalyst and --**

14 **A. That is correct.**

15 **Q. -- and table 2 is nickel-alumina**
16 **co-precipitated catalyst, right?**

17 **A. That is correct. And then table 3 and 4**
18 **is nontreated gamma-alumina. So neither is -- none**
19 **of the Chokkaram catalysts are treated the way the**
20 **Wu catalyst was.**

21 **Q. Okay. I want to turn to -- back to your**
22 **declaration on page 16. Paragraph 33, bottom of**

117

1 the page you say "A POSITA would understand that an
2 example of ordered claims includes, see originally
3 filed claims 11, 13, and 15," and I just want to
4 understand what you mean by "ordered claims." Does
5 that refer to the order in which base treatment and
6 calcination is done?

7 **A. Claims 11, 13, and 15, the originally**
8 **filed claims 11, 13, and 15 seem to build on each**
9 **other. That is talking about the gamma-alumina**
10 **catalyst and then the same gamma-alumina catalyst**
11 **treated with a calcium promoter and then that**
12 **modified alumina catalyst, presumably the one**
13 **that's been treated with the calcium promoter, is**
14 **calcined. So yes, they build on each other.**

15 **Q. Okay. And the order -- just to be clear,**
16 **I'm just questioning what you mean by the term**
17 **"order." Does the order refer to the order of**
18 **steps in terms of base treatment and then**
19 **calcination as opposed to calcination followed by**
20 **base treatment?**

21 **A. One might construe that but it does not**
22 **say that specifically.**

1 Q. So I think you testified earlier about Wu,
2 that a POSITA would understand that a base-treated
3 catalyst is always calcined, correct?

4 A. I know that from Wu, but that is not what
5 the language here says.

6 Q. Right. Let's just -- so it's your -- is
7 it your testimony that a POSITA could do a
8 calcination followed by a base treatment and not
9 know what's going to happen?

10 A. Based strictly on '048, the POSITA would
11 not understand that calcination must follow base
12 treatment. The POSITA might well learn that from
13 other sources, but it does not say that here.

14 Q. Right. And I think it was your testimony
15 earlier on Wu that you said a POSITA knows that
16 calcination always follows base treatment, correct?

17 A. Based on the prior literature, yes.

18 Q. Okay. And we talked a little bit about
19 the base treatments in Wu. I think potassium
20 hydroxide and sodium hydroxide are specifically
21 disclosed in Wu, correct?

22 A. Yes.

1 Q. And similarly in the '048 Patent there's a
2 disclosure of sodium, potassium, and I believe
3 calcium, right?

4 **A. I'd have to look at it. I don't remember.**

5 Q. Well, you can look at your declaration
6 here which is quoting from the '048 Patent and
7 generally says that the base can include a group 1
8 or group 2 metal. And I think it's your opinion in
9 your declaration here that that doesn't
10 sufficiently describe all of the base treatments
11 that could happen, right?

12 **A. I would rather phrase it that there's no**
13 **evidence in '048 that this range of base treatments**
14 **was practiced. There's no evidence that the**
15 **representatives from this broad group all work.**

16 Q. Right. And that's because you could get
17 much different results depending on the type of
18 base treatment that's used; is that right?

19 **A. We have no information about what will**
20 **happen with other -- we'll call them all base**
21 **treatments. They're not necessarily all bases, but**
22 **these group 1 or group 2 metal salts, we have no**

1 information about what's going to happen with them.
2 We know from Wu the potassium hydroxide and sodium
3 hydroxide, especially potassium hydroxide work.
4 The '048 teaches us that calcium acetate I believe
5 it was works and that's all we know.

6 Q. Okay. Is there any other prior art you
7 reviewed that talks about base treatments?

8 A. None that we refer to I don't think. I've
9 read a great deal of background on this case and I
10 cannot point to anything in particular, but I've
11 certainly seen in passing barium salts and
12 magnesium salts being used.

13 Q. So are you familiar with the
14 requirement -- the written description requirement
15 of section 112?

16 A. I've not read section 112. So I can't
17 quote it to you.

18 Q. Okay. What's your understanding of the --
19 in general terms what is required by written
20 description for a patent?

21 A. My understanding is that the patent has
22 to -- and I think this is beyond the scope of what

1 we're doing here, but I think that the patent has
2 to enable.

3 Q. Right. Are you aware of the enablement
4 requirement of section 112?

5 A. I don't know if section 112 has an
6 enablement requirement. I don't know anything
7 about section 112.

8 Q. Okay. Are you aware that the enablement
9 requirement of section 112 and the written
10 description requirement of section 112 are separate
11 requirements?

12 A. If you tell me that I'll believe you.

13 Q. Okay. In forming your opinions that you
14 offer in this declaration was the written
15 description requirement explained to you?

16 A. Not that I can recall.

17 Q. Okay. So --

18 A. It's my understanding that the -- a
19 description in the patent of a broad area of
20 possibilities is not sufficient without specific --
21 without examples of those.

22 Q. Right. And is that because this field of

1 catalyst treatments and developing catalysts is
2 unpredictable?

3 **A. Based on what we know from this**
4 **background, the development of reliable catalysts**
5 **is quite predictable.**

6 Q. Right, but for any particular catalyst and
7 any particular treatment, in order to know whether
8 that particular treatment and what the result is in
9 terms of regioselectivity, conversion, and, say,
10 time on stream you'd actually have to do the
11 experiment to find out what those effects would be,
12 right?

13 **A. Going back to the POSITA, we don't know**
14 **their instructions of what they need to achieve to**
15 **be successful, but broadly speaking, the literature**
16 **on dehydration would teach -- does teach that the**
17 **base-modified and then calcined catalysts are**
18 **apparently quite reliable.**

19 Q. Right. And yet it's your testimony at
20 paragraph 35 of your declaration that a disclosure
21 of sodium, potassium, and calcium treatments does
22 not "signify possession of all bases, group 1

1 metals, or group 2 metals," right?

2 **A. That's correct.**

3 Q. So why is that?

4 **A. Because not all group 1 and group 2 metals**
5 **are included. Within the range of the ones that**
6 **are known, potassium hydroxide, sodium hydroxide,**
7 **calcium, probably barium salts, there's every**
8 **expectation of success as was observed here. For**
9 **the other group 1 or group 2 metals there's far**
10 **less evidence.**

11 Q. Okay. So --

12 **A. There's certainly no evidence in '048.**

13 Q. Well, in terms of the required disclosure
14 too, what would be in your opinion a sufficient
15 number of group 1 and group 2 metals that would
16 need to be tested in order to show possession of
17 that general genus of metals?

18 **A. I don't think there's any validity in**
19 **claiming a general group when there's no evidence**
20 **that they work.**

21 Q. Right. And in terms of evidence that they
22 work, you're saying you would need to see

1 experiments for every one of the metals?

2 **A. If I were to believe that a particular**
 3 **metal that isn't well preceded also worked, yes,**
 4 **I would want to see an experiment demonstrating**
 5 **that. And as a POSITA I would not be motivated to**
 6 **explore other metals if I know that these work and**
 7 **are expected to work.**

8 Q. So as a POSITA you would be motivated to
 9 use sodium, potassium, or calcium and none of the
 10 other group 1 or group 2 metals; is that right?

11 **A. Initially I would -- as a POSITA I would**
 12 **follow the literature and do what I was taught to**
 13 **do. Only if that were not successful would I be**
 14 **motivated to look beyond that.**

15 Q. But in the context of showing possession
 16 of a -- in order to claim base treatment using
 17 group 1 or group 2 metals how many of those metals
 18 would need to be described experimentally in order
 19 to show possession of that claim?

20 **A. I don't know what the legal requirements**
 21 **are. To my mind the practical requirement would be**
 22 **that one has to demonstrate that that particular**

1 **metal works.**

2 Q. I want to hand you a copy of De Bruyn,
3 Exhibit 1008.

4 **A. Thank you.**

5 Q. Which we looked at before. I don't have a
6 lot of questions for you, but I did want to ask you
7 about some testimony you gave earlier today saying
8 that the catalysts of De Bruyn were calcium
9 modified; do you recall that?

10 **A. Yes.**

11 Q. And what's the basis for that statement?

12 **A. Paragraph 37.**

13 Q. Okay. And this is -- the last sentence of
14 paragraph 37 says "The catalyst may compromise a
15 gamma-alumina catalyst or a promoted alumina
16 catalyst, e.g. calcium oxide-alumina and calcium 2
17 oxide-alumina," right?

18 **A. Yes.**

19 Q. Is it your testimony that the catalysts
20 that were used in the examples of De Bruyn were
21 also calcium treated?

22 **A. De Bruyn does not specify. Example 3 is**

1 **the example for the dehydration and it does say**
2 **gamma-alumina.**

3 Q. And it just says gamma-alumina, correct,
4 in example 3?

5 A. Yes. We do not know if this is calcium
6 promoted or not.

7 Q. And then in example -- I think it's
8 example 4, step 5, beginning at paragraph 67, 68
9 there's another catalyst, pural kr-1, right?

10 A. Yes.

11 Q. Would a POSITA understand that that is a
12 modified or in some way treated or promoted
13 gamma-alumina catalyst?

14 A. From the evidence here this says whether
15 it's calcium promoted or not.

16 Q. Okay.

17 A. From paragraph 37 there is the possibility
18 and in my opinion the likelihood, but does not
19 specifically say that.

20 Q. Well, I think you testified earlier that a
21 POSITA would know that calcium-modified alumina
22 catalysts are available from Sasol; do you remember

1 that?

2 **A. Sasol certainly owns competent catalysts**
3 **and from what we read here my expectation is that**
4 **those catalysts are probably calcium promoted, but**
5 **we do not know that that would be available to the**
6 **POSITA. Whatever pural kr-1 is, it appears to be**
7 **an effective catalyst with durable, long run times,**
8 **good selectivity, and that the POSITA would like to**
9 **buy it, but that doesn't mean it's available to**
10 **them.**

11 **Q. Right. And a POSITA reviewing paragraph**
12 **37 wouldn't know how much calcium would need to be**
13 **added based on this disclosure to provide an**
14 **enhancement of regioselectivity or conversion,**
15 **right?**

16 **A. There are no details here about that.**

17 **Q. There's nothing about the amount of**
18 **calcium that's present or how it would be calcined**
19 **afterwards, right?**

20 **A. No.**

21 **Q. And looking at -- going back to example 3,**
22 **which is at paragraph 53, I believe you testified**

1 earlier today that in example 3 the inventors
2 improved the yield by doing recycling of the
3 unreacted 1-hexanol, right?

4 **A. Yes.**

5 Q. Is that a common way to improve the
6 overall yield for dehydrations?

7 **A. I expect that on a large scale, for**
8 **instance, a metric ton scale that would be a very**
9 **common practice.**

10 Q. Okay. And it's certainly what the
11 inventors did here in order to improve the yield,
12 right?

13 **A. Yes.**

14 Q. Have you ever worked on or worked with a
15 process in which the unreacted reagent was recycled
16 and sent back through the reactor?

17 **A. Let me rephrase that. Have we ever worked**
18 **with a process where the unreacted starter material**
19 **was recycled and sent back through the process,**
20 **yes.**

21 Q. Okay. In the context of designing an
22 industrial process, have you ever worked with that?

1 **A. As I testified before, I've never been**
 2 **employed in an industrial lab with responsibility**
 3 **for scale-up. I've certainly talked with my**
 4 **friends about what they do and this comes up as a**
 5 **standard practice.**

6 Q. And this is a pretty standard practice?

7 **A. Yeah.**

8 Q. And looking at that same paragraph 37 in
 9 De Bruyn, there's also a discussion of alumina
 10 silica titania or alumina silica zirconia catalyst;
 11 do you see that?

12 **A. Yes.**

13 Q. Based on this disclosure in De Bruyn,
 14 would a POSA be similarly motivated to use those
 15 catalysts?

16 **A. I think the most useful sentence in this**
 17 **paragraph is the first one. "Many different**
 18 **dehydration processes are known and they are**
 19 **not accordingly -- and they are accordingly not**
 20 **discussed in any detail in this specification."**

21 Q. Right.

22 **A. To answer your question, it's not clear**

1 from the punctuation what's going on here. It
2 looks like the alumina, the silica, the titania,
3 and the zirconia are separate, they're not
4 combined. They're just alternative possibilities.
5 And so it goes from very general to very specific
6 from alumina or silica or titania or zirconia to
7 gamma-alumina to calcium-promoted gamma-alumina.

8 Q. Right. Well, it's fair to say that they
9 could have included some more detail in that
10 paragraph, right?

11 A. They specifically say they're not
12 including details, but we can see a trend in their
13 description that it could be maybe any of these
14 things but all the way down to very specifically
15 the calcium-promoted alumina.

16 Q. Okay.

17 A. And, of course, De Bruyn works for Sasol,
18 he knows what a Sasol catalyst is, and there may be
19 some disclosure of that here.

20 Q. All right. So the ground that you discuss
21 for obviousness in your declaration is I believe a
22 combination of Le in view of De Bruyn, right?

1 **A. Yes.**

2 Q. Why does -- why would a POSITA have to
3 look at both of those references in order to
4 practice a dehydration reaction? Why not just look
5 at De Bruyn?

6 **A. Let's go back and look at Le. Could we?**

7 Q. Well, I'd like to hear your testimony
8 about why you need to look at Le and De Bruyn
9 together first?

10 **A. I really can't speak to Le until I have Le**
11 **in front of me.**

12 Q. Okay. Well, I'll give you a copy of Le.
13 Le, Exhibit 1007. L-E, Le.

14 **A. As you'll recall, '048 speaks in**
15 **particular about dehydrating bio-1-octanol.**
16 **1-octanol derived from natural sources. De Bruyn**
17 **does not speak about bio-1-octanol. We don't know**
18 **what De Bruyn's source of 1-octanol is. Le speaks**
19 **specifically about dehydrating bioderived**
20 **alcohols.**

21 Q. Okay. It's fair to say Le doesn't
22 explicitly disclose regioselectivity and conversion

1 while De Bruyn's examples actually do disclose
2 regioselectivity and conversion, right?

3 **A. I believe Le speaks about**
4 **regioselectivity.**

5 Q. Can you point me to a specific example in
6 Le that discloses the regioselectivity of a
7 product?

8 **A. If we look, for instance, at 0105,**
9 **dehydration of the heptan-1-ol so as to form**
10 **1-heptene. Above that in 0100 dehydration of the**
11 **hexan-1-ol so as to form hex -- 1-hexene. Then in**
12 **0109 dehydration of the octan-2-ol so as to form a**
13 **mixture comprising 1-octene and 2-octene. And so**
14 **he is not speaking here -- Le is not speaking about**
15 **yield, but we assume the yield is pretty good or**
16 **they would not be reporting it. But they are**
17 **speaking very specifically about regioselectivity**
18 **of the dehydration that -- we know that they know**
19 **what 2-alkene looks like because they create**
20 **2-alkenes along with the 2-octenes, plural, along**
21 **with the 1-octene when they dehydrate octan-2-ol**
22 **just as Chokkaram did. What that teaches us, when**

1 they say they got 1-hexene or 1-heptene, they know
2 very well what 2-heptene or 2-hexene would look
3 like and they did not observe them -- did not
4 report them.

5 Q. Right. And it's your testimony that these
6 examples at paragraphs 100, 105, and 109 were
7 actually performed by Le, that a POSITA would
8 review this part of the document and understand
9 that these were experimental examples that were
10 actually performed by Le; is that your testimony?

11 A. Yes.

12 Q. Okay.

13 A. They are not listed as examples in the
14 patent here because if the patent is all -- the
15 examples in the patent are about using the
16 1-alkenes so produced or in this case 2-alkenes.

17 Q. Right. And then I believe at paragraph
18 184 you point to the fact that in the table below
19 that 1-heptene is only listed and no 2-heptene; is
20 that right?

21 A. That's true.

22 Q. And I'll direct your attention up above to

1 paragraph 173 which follows -- at paragraphs 171
2 and 172 there's actually a description of an
3 experiment that was done using 1-heptanol in making
4 heptene and there's no disclosure of the conversion
5 or regioselectivity, right, at paragraphs 171 or
6 172?

7 **A. Those are not mentioned.**

8 Q. And at paragraph 173 we see that a step of
9 purifying the 1-heptene is performed before
10 carrying out the polymerization steps of the
11 process; do you see that?

12 **A. Yes.**

13 Q. And so if pure 1-heptene was formed by the
14 process, there would be no reason to perform a
15 separate distillation step, right?

16 **A. It would take a very exacting distillation**
17 **to separate 1-heptene from 2-heptene. The...**

18 Q. Let's try my question. If pure 1-heptene
19 was prepared, there would be no reason to distill
20 it, right?

21 **A. If I were carrying this out, I separate**
22 **the 1-heptene and the water and then I distill the**

1 **1-heptene to make sure all the water is gone**
 2 **because the water might be deleterious to my**
 3 **catalyst, but it says nothing about the purity of**
 4 **the 1-heptene before or after that distillation.**

5 Q. Right. Only that something needed to be
 6 further purified?

7 A. And the most likely suspect is what had to
 8 be removed was the last traces of water.

9 Q. Right. But we don't know that based on
 10 Le's disclosure, do we?

11 A. They do not say why or how it was
 12 purified.

13 Q. I want to hand you a copy of Wright '788.
 14 This is Exhibit 1009. We looked at this before,
 15 Doctor. There's also a single example disclosed in
 16 this patent beginning at paragraph 34 and running
 17 through table 1. Do you see that on the top of
 18 page 4? Do you see that?

19 A. Yes.

20 Q. And it's fair to say that the only example
 21 disclosed in Wright '788 is a catalyst that was
 22 first base treated, dried, and then modified with

1 diphenyldichlorosilane and then air dried and
2 loaded into a reactor; is that right?

3 **A. Air dried, loaded into a reactor, and**
4 **heated to 380 degrees.**

5 Q. Yeah. There's no example in Wright '788
6 that simply looks at a base-treated catalyst,
7 right?

8 **A. It's not clear. In 0020 they specifically**
9 **talk about base washing an alumina catalyst and**
10 **then reacting it with a chlorosilane, but in other**
11 **embodiments the base is selected from sodium or**
12 **potassium hydroxide and they talk about the contact**
13 **time with the gamma-alumina but not about silane.**
14 **And so they may well have had gamma-alumina**
15 **catalysts that had not been treated with silane.**

16 Q. They're not recorded in the patent,
17 correct, in Wright '788?

18 **A. In the beginning of example 1 the only**
19 **catalyst they mentioned is being treated with**
20 **silane, with chlorosilane.**

21 Q. And if Wright '788 had conducted any
22 experiments with a catalyst that had only been base

1 treated, a POSITA would have expected to see that
2 data in example 1 or another example, right?

3 A. No, not necessarily. If they had used
4 such a -- they discuss this briefly in 0025.

5 Q. Discuss what briefly in 0025?

6 A. The limitations of the -- the shortcomings
7 of using gamma-alumina to dehydrate 1-alcohols.
8 And I don't know if we have this reference, but the
9 study showed gamma-alumina showed significant loss
10 of selectivity for conversion of 1-alcohols to
11 1-alkenes with time on stream. And so they were
12 happy to find that treating the catalyst with
13 silane led to much improved time on stream.

14 Q. Treating the catalyst with silane led to
15 improvements in time on stream, right?

16 A. Yes.

17 Q. Right. And that reference that's being
18 cited at paragraph 25 of Wright '788, the Makgoba
19 reference, which is M-A-K-G-O-B-A, that's actually
20 another document that you cite in your
21 declarations, right? I believe it's Exhibit 1027.

22 A. I'm going to agree to that without looking

1 **it up.**

2 Q. And --

3 A. There it is. Okay. Which also used --
4 **yes, also treated the gamma-alumina catalyst with**
5 **silane to improve activity.**

6 Q. Right. So your testimony is Makgoba also
7 disclosed gamma-alumina catalysts treated with
8 silane to improve activity?

9 A. That's what it says. This is specifically
10 **referring to the bioderived 1-butanol which has**
11 **water in it.**

12 Q. There was no question pending, Doctor.
13 Move to strike that.

14 I'm handing you a copy of Wright '451,
15 which is Exhibit 1039. Do you recognize this
16 document?

17 A. Yes.

18 Q. So this is a new reference that was not
19 cited in your first declaration but is in your
20 second declaration, right?

21 A. Yes.

22 Q. How did you come across this document?

1 **A. We already had it and I was reading back**
2 **through the materials that we had and reread '451**
3 **and realized the relevance to the case.**

4 Q. Okay. So at the time you put your first
5 declaration together you didn't think it was
6 relevant, you reread it, and now you think it's
7 relevant; is that right?

8 **A. At the time of my first declaration I had**
9 **no opinion about '451.**

10 Q. But you had read it, right?

11 **A. I had seen it. I do not know if I had**
12 **read it in detail.**

13 Q. Okay. What prompted you to go back and
14 look at Wright '451 again?

15 **A. I was rereading all the materials for the**
16 **case in detail.**

17 Q. And you didn't do that the first time?

18 **A. I don't recall how much time I spent with**
19 **'451 the first time.**

20 Q. How much time have you spent on this case
21 altogether, Doctor?

22 **A. Probably about a hundred hours.**

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1 Q. And that's all your time for your first
2 declaration and your second declaration?

3 A. Yes.

4 Q. All right. What's your hourly rate for
5 this case?

6 A. I get paid \$400 an hour.

7 Q. Okay. How much time did you spend going
8 back and looking at prior art in preparation for
9 your second declaration?

10 A. How many hours? I don't recall.

11 Q. Generally speaking.

12 A. I can look back at my log of hours and try
13 to relate that to what I was doing at the time, but
14 I really don't recall.

15 Q. More than 20?

16 A. In that particular time period, probably
17 10 to 12.

18 Q. And so how is Wright '451 now relevant to
19 your opinions?

20 A. Wright '451 seems to very closely
21 anticipate '048 and '803, which we'll get to.

22 Q. Okay.

1 **A. And, in fact, has a very detailed**
 2 **description of how to treat the gamma-alumina**
 3 **catalyst with calcium acetate, how to calcine it --**
 4 **dry it, calcine it.**

5 Q. In your opinion is Wright '451 more
 6 relevant to your analysis of obviousness than
 7 Wright '788?

8 **A. My recollection is that Wright '451**
 9 **specifically speaks to the dehydration of 1-octanol**
 10 **as being included in the range of things.**

11 Q. Well, I think it was also your testimony
 12 that Wright '788 could be used for longer chain
 13 alcohols, right?

14 **A. Yes.**

15 Q. And there's no examples in Wright '451 of
 16 dehydration of 1-octanol, correct?

17 **A. I have not read them all, but they all**
 18 **seem to refer to 1-butanol.**

19 Q. Okay. And the only example in Wright '788
 20 also referred to 1-butanol, correct?

21 **A. Yes. One big difference between '451 and**
 22 **'788 is that in '788 -- sorry -- in '451 they are**

1 **now adding heptane to the 1-butanol which would**
2 **serve to drive the water out of it.**

3 **Q. Sorry. Drive the water out of what?**

4 **A. Out of the 1-butanol. So they're doing a**
5 **phase separation of water from the 1-butanol, then**
6 **adding the 2 percent heptane would drive the water**
7 **out of the 1-butanol. And so the 1-butanol going**
8 **onto the catalyst would have much less water than**
9 **1-butanol direct from bio production.**

10 **Q. Okay. But --**

11 **A. Now they find that it's not important to**
12 **salinize the catalyst.**

13 **Q. Wright '451 also includes a lot more**
14 **examples, doesn't it?**

15 **A. Wright '451 is much longer than Wright**
16 **'788. I will add that bio-1-butanol with heptane**
17 **added makes a starting material that's much more**
18 **similar in composition to 1-octanol than just**
19 **1-butanol would be.**

20 **Q. Right. And why would that be important to**
21 **a POSITA reviewing Wright '451 versus Wright '788?**

22 **A. That the POSITA would know that adding the**

1 **1 -- adding the heptane to the 1-butanol would**
2 **drive the water out of the 1-butanol. And so we**
3 **now have an alcohol which -- an alcohol starting**
4 **material for the dehydration that is similar in**
5 **water content to the 1-octanol.**

6 Q. Yeah. In either case, though, you're
7 still generating water from the dehydration,
8 correct?

9 A. Yes.

10 Q. And so a catalyst that has resistance to
11 degradation from water is always going to be
12 important, right?

13 A. A catalyst being resistant to degradation
14 by water will always be important, but there's a
15 difference between generating water somewhere down
16 this catalyst column as steam, in vapor phase, and
17 the very wet bio-1-butanol coming down onto -- in a
18 liquid form coming down onto a hot catalyst. So
19 there's much more water approaching the catalyst
20 with the wet bio-1-butanol.

21 Q. So just so we're clear, in all of these
22 examples we're not adding liquid onto any of these

1 reactors in Wu, in Wright '788, in Wright '451, or
 2 is it your testimony that literally wet liquid
 3 phase reagents are being added onto the catalyst?

4 **A. Well, liquid phase starting materials are**
 5 **being added. At some point they vaporize at the**
 6 **temperatures of the reactor.**

7 Q. And so you're saying they're not
 8 preheated?

9 **A. There may be a preheating in the reactor.**

10 Q. No. Before the reagents get to the
 11 reactor your testimony is they enter the reactor as
 12 liquids and then hit the catalyst?

13 **A. I don't see a reactor design outlined**
 14 **here. So I do not know.**

15 Q. How about De Bruyn and Le, are they adding
 16 liquid reagents onto their reactors?

17 **A. Nor do they have a reactor design. So I**
 18 **do not know.**

19 Q. What is your understanding about how these
 20 processes are conducted under normal conditions in
 21 the art? Is it your testimony that under normal
 22 conditions liquid reagents are added directly into

1 the reactor?

2 **A. From an engineering point of view there**
3 **would have to be containment of the substrate, of**
4 **the starting material going in. And so in the**
5 **world outside the reactor these starting materials**
6 **are liquids. Somehow they get into the reactor,**
7 **not necessarily the catalyst bed but into the**
8 **reactor, they would have to go in as liquids. If**
9 **you define the reactor as only being the catalyst**
10 **bed, then presumably the liquids are not coming**
11 **into contact with the catalyst bed. But if you**
12 **define the reactor as being the whole reactor from**
13 **where you put the substrate in, then yes, they go**
14 **in as liquids.**

15 **Q. But I think it was your testimony also**
16 **that water in the reagent stream, the input is --**
17 **is affecting the catalyst, it's coming into contact**
18 **with the catalyst and adversely affecting it, but**
19 **water being generated from the catalytic**
20 **dehydration doesn't impact the catalyst?**

21 **A. The concentration of water on the catalyst**
22 **would be much higher for the wet 1-butanol than it**

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1 would be for octanol or for bio-1-butanol to which
2 heptane had been added to remove the water. We can
3 construe from the combination of '788 with '451
4 that on removal -- on drying, if we want to use
5 that term, of the bio-1-butanol whatever was going
6 on adversely with the gamma-alumina catalyst, the
7 required silanization was no longer a problem.

8 Q. Okay. So you'll agree that Wright '788
9 then is teaching that silanization is required to
10 improve catalyst performance in that document,
11 right?

12 A. Silanization is required if one is going
13 to use the wet bio-1-butanol in the dehydration.
14 Silanization following '451 is not required if one
15 first dries the bio-1-butanol by adding the weight
16 percent heptane.

17 Q. Okay.

18 What would a POSITA's understanding be of
19 the concentration of water that's in bio-1-butanol?
20 I know we talked about that earlier, but what is
21 the specific percentage that should be present in
22 bio-1-butanol?

1 A. I'm sure there are handbooks that talk
2 about the solubility of water in 1-butanol. That
3 would be the same whether bio-1-butanol or
4 petroleum-derived 1-butanol. Certainly if the
5 POSITA had the bio-1-butanol in, say, a graduated
6 cylinder and added the heptane and they look, oh
7 look, there's a much bigger water layer than there
8 was before, they would then start to get some
9 quantitation of how much water they're getting out
10 of their bio-1-butanol.

11 Q. Okay. So it's fair to say you don't have
12 any idea?

13 A. I have no numbers in front of me of how
14 much water is in the bio-1-butanol.

15 Q. And it's your testimony that a POSITA
16 similarly wouldn't know how much water is present
17 in bio-1-butanol?

18 A. If a POSITA wanted to ask that question,
19 which quite likely they would be motivated to do,
20 they could look it up in a moment and know for
21 sure. Of course, it would depend on the
22 temperature of the mixture.

1 Q. Now, a POSITA who's trying to dehydrate
2 octanol, 1-octanol, why would a POSITA worry about
3 looking at patents that are specifically designed
4 for dehydrating bio-1-butanol as being relevant
5 when they have other publications like De Bruyn and
6 Le that specifically go to 1-octanol?

7 A. The POSITA is under significant time
8 pressure to get a successful result. And so the
9 POSITA would be motivated to find the most detailed
10 accounts of catalyst preparation and optimization
11 before starting experiments. The 1-butanol is a
12 primary alcohol, 1-octanol is a primary alcohol.
13 Usual expectation is they would react in a very
14 similar fashion.

15 Q. Okay. But there's actually no data in
16 either of these references, Wright '788 and Wright
17 '451, for 1-octanol, right?

18 A. Both patents state that 1-octanol works,
19 but there are no examples using 1-octanol.

20 Q. Right. And if you wanted to see examples
21 of 1-octanol, I think the only reference that
22 specifically looks at the longer chain alcohols

1 with a disclosure of conversion and
2 regioselectivity is De Bruyn, correct?

3 **A. Well, the early dehydration articles,**
4 **1944, 1945, very early on they don't have details**
5 **of gamma-alumina preparation or calcidation or any**
6 **of those things where they show good conversion of**
7 **regioselectivity.**

8 Q. Correct. And you don't even cite those in
9 your second declaration, correct?

10 **A. I don't recall. They were certainly cited**
11 **in the first declaration.**

12 Q. Right. They're not discussed anywhere in
13 your second declaration. So I go back to, again,
14 if you were a POSITA under time pressure and you
15 needed to absolutely have success in dehydrating
16 the 1-octanol, again, why would you look at a
17 reference that was focused on dehydrating
18 bio-1-butanol rather than going to a reference that
19 explicitly discloses longer chain alcohols?

20 **A. It's very difficult to get into the mind**
21 **of the POSITA. And so I have to use only my own**
22 **experience, which was who's doing this. Sasol's**

1 **doing this, they're dehydrating 1-octanol, great.**
2 **There is a Sasol patent, De Bruyn. Oh, focus it**
3 **down on calcium promoted. Who's using calcium**
4 **promotion to do a dehydration of a primary alcohol?**
5 **Oh, Wright is and there's '788, but then '451**
6 **improved that. He got a bio butanol dryer and now**
7 **it's working great and he's told me exactly how to**
8 **make the catalyst. I'm a happy man or woman.**

9 Q. Okay. But there's still no evidence in
10 Wright, there's no examples, no experiments that
11 actually show it works for 1-octanol, correct?

12 A. No, but as a POSITA I would know that the
13 heptane-treated bio-1-butanol is very similar to
14 1-octanol.

15 Q. Okay. So it's your testimony that rather
16 than use the commercially available catalyst from
17 Sasol you would go try to reproduce the catalyst
18 from Wright and use that instead; is that fair?

19 A. No. No. I have no evidence that the
20 POSITA has an excessive -- has access to the Sasol
21 catalyst. If I as a POSITA could purchase the
22 Sasol catalyst, I would probably do that and use

1 **it. If I had to make a catalyst that was**
2 **effective, I might very well be led to Wright '451.**

3 Q. Okay. Based on your review of the prior
4 art, what is the closest prior art to the
5 '048 Patent?

6 **A. I would have to say Wright '451.**

7 Q. And why is that?

8 **A. Because it talks in the same detail about**
9 **how to prepare the catalyst. More detail actually.**

10 Q. I wanted to look with you at Wright '451
11 if you have it in front of you at page 26.

12 **A. Yes.**

13 Q. Paragraph 98 specifically. And it turns
14 out you're already there. All right.

15 Comparative catalyst 6, do you see that?

16 **A. Yes.**

17 Q. It was prepared according to the procedure
18 described in U.S. Patent No. 4,234,752, and that is
19 the Wu patent, correct?

20 **A. I don't know. Yes, it is.**

21 Q. Okay. And in this Wright '451 patent when
22 they practice Wu's invention they take a

1 commercially available strem, S-T-R-E-M,
2 gamma-alumina powder and they contact that with a
3 sodium hydroxide solution, they isolate by
4 filtration, wash with water, dry at 200 C for 24
5 hours, and then use it as a dehydration catalyst,
6 correct?

7 **A. That's what they say, yes, that's**
8 **correct.**

9 Q. Okay. So they don't calcine the catalyst
10 of Wu, correct?

11 **A. Yes. Wu may have calcined at 350, but**
12 **they say they only went to 200.**

13 Q. Well, Wu doesn't actually say that the
14 catalyst was calcined, right?

15 **A. Wu operated at 350 degrees, which is well**
16 **into calcination temperatures.**

17 Q. There was no separate calcination step
18 described in Wu, right?

19 **A. That is correct.**

20 Q. Okay. And if we look at page 30,
21 paragraph 118 -- sorry. I don't want to skip that
22 far ahead. Or no, that's right, yeah. Paragraph

1 118 it describes the reaction conditions that were
2 looked at. And it says "Catalyst example 6 through
3 11, 18, and 19 were prepared" -- keep going down --
4 there's a bio-1-butanol feed that contains
5 88 percent butanol, 2 percent heptane, and
6 10 percent water; do you see that?

7 **A. So they're deliberately adding water.**

8 Q. I don't know. Are they deliberately
9 adding water or is that just the amount of water
10 that's present in bio-1-butanol?

11 **A. That's an interesting question. They say**
12 **they're adding the heptane as an internal standard,**
13 **but they are not -- we do not know if the**
14 **bio-1-butanol 88 weight percent and 10 percent**
15 **water is just inherent water or if they're adding**
16 **it.**

17 Q. Okay. And the 10 weight percent water
18 that's disclosed here with the bio-1-butanol and
19 the heptane was passed over the catalyst,
20 temperature was controlled, and I believe the
21 reaction -- the reactor temp was 400 degrees C, but
22 I would like to know if you agree with that.

1 A. Well, let's back up the sentence.

2 Q. Sorry.

3 A. They have an initial treatment with this,
4 **bio-1-butanol containing 10 percent water and**
5 **they're monitoring it, and after the completion of**
6 **the above test the feed was switched to 7**
7 **weight percent 1-butanol in water.**

8 Q. Right. And that is for aging, but we'll
9 get to that in just a second. I see on the next
10 page in table 2 it actually does include the
11 reactor temp as the third column in table 2, and it
12 looks like the reactor temperatures of 360 and 380
13 were used?

14 A. Yes. So, again, well into calcination
15 **range.**

16 Q. And, again, Wu as example 6 is showing
17 with no aging, in other words no flowing of water
18 through the reactor, a conversion of 89.4 percent
19 and a selectivity of 95.9 percent was obtained,
20 right?

21 A. Are we in Wu now?

22 Q. I'm sorry. I'm in table 2, example 6 is

1 Wu.

2 A. Oh, okay. So example 6 is preparing the
3 catalyst according to Wu.

4 Q. Uh-huh.

5 A. And now they're at 380, no aging time, and
6 then 60 hours, then 120 hours, and they see
7 degradation of conversion but not selectivity.

8 Q. Right.

9 A. And so they're deliberately assaulting
10 their catalyst with water.

11 Q. And it's a high concentration of water,
12 but you'll agree water is generated during the
13 dehydration and therefore a POSITA motivated to
14 have a longer time on stream would choose a
15 catalyst that did not show a decrease in conversion
16 with aging time, right?

17 A. A POSITA dehydrating 1-octanol would not
18 be approaching anywhere near the water treatment of
19 these examples.

20 Q. Well, certainly you would be after several
21 months. This is 60 hours, which is two days, but
22 if you're running this for months at a time, you're

1 going to see a considerable amount of water on that
2 reactor, correct?

3 **A. No, not at any one time. The substrate's**
4 **going through, the water's coming out. You would**
5 **never have these concentrations of water on the**
6 **catalyst at any time.**

7 Q. So you're saying that concentration is
8 important?

9 **A. Concentration may be important and the**
10 **concentration of the water on the catalyst here is**
11 **far higher than anything you would see with a**
12 **1-octanol dehydration, but in any case, the '451**
13 **certainly teaches how to solve that problem.**

14 Q. It does. It discusses -- I believe it's
15 calcium promotion and then also calcium promotion
16 and silanization as being options, correct?

17 **A. Yes, but finding that silanization is not**
18 **required. That simple calcium promotion solves the**
19 **problem.**

20 Q. Okay. So is it your opinion that a POSITA
21 reviewing Wright '451 wouldn't necessarily view Wu
22 as being relevant? They would instead just simply

1 practice what's taught by Wright '451?

2 **A. Again, we don't know the motivation of the**
3 **POSITA. If the POSITA required longer run times,**
4 **then they would learn from Wright '451 that longer**
5 **run times can be achieved with Wright's catalyst**
6 **preparation.**

7 MR. LUKAS: We can go off the record.

8 (A break was had.)

9 BY MR. LUKAS:

10 Q. All right, Doctor. I think we were
11 talking about Wright '451 before we took a break.
12 Do you remember that?

13 **A. Yes.**

14 Q. And table 2 specifically listed some
15 reaction conditions and specifically there's
16 temperatures of 360 and 380 degrees C that are
17 described in Wright '451 as the reactor
18 temperatures; do you see that?

19 **A. Yes.**

20 Q. Based on your review of the art, are these
21 reactor temperatures in the normal range or on the
22 high end of what you would normally see for the

1 dehydration of 1-alkanols?

2 **A. They're certainly comparable to Wu, which**
3 **we just looked at. The others I don't recall.**

4 Q. Okay. Would you agree that there's
5 generally a decrease in reactivity for doped or
6 modified catalysts that the requires higher
7 temperatures?

8 **A. There's no evidence of that here. We**
9 **could look back at some of the other prior art and**
10 **see what they did.**

11 Q. I want to hand you what I believe will be
12 Exhibit 2008. This is a document not cited in
13 your report. It's PCT Publication
14 No. WO-2022122139. I have another copy here too,
15 somewhere. And I wanted to turn with you to
16 paragraph 56. Well, first of all, feel free to
17 take a look at the document. At least in the
18 abstract the title is "Process for the efficient
19 preparation of bio-alkanediols and the abstract
20 says "The present invention relates to process for
21 the efficient, sustainable, and gentle preparation
22 of bio-based alkanediols, especially

1 1,2-alkanediols." And paragraph 56 says -- and
2 that's on page 14 -- "Usually the selectivity of a
3 reaction can be increased by using doped or
4 modified catalysts. However, due to a decrease in
5 reactivity generally higher reaction temperatures
6 are required"; do you see that?

7 A. Yes.

8 Q. Do you agree with that statement?

9 A. My recollection is that the dehydration
10 reactions are exothermic and that when running in
11 a -- through a catalyst column the feed is
12 controlled so as to maintain the temperature.
13 They're speaking here of costly insulation. You
14 deliberately do not insulate because you want to
15 radiate the heat of the reaction. And so I'm not
16 sure how this is relevant to the other dehydrations
17 we've been talking about.

18 Q. Well, let's take a look at page 48 of the
19 document. And claim 1 specifically is a process
20 for the preparation of alkanediols having 5 to 15
21 carbon atoms. The first step is to provide the
22 alcohol in a catalyst, the C5 to C15 alcohol, and

1 dehydrate it with a catalyst, and it says that the
2 dehydration is performed at a temperature ranging
3 from 255 to 290 C, correct?

4 **A. Yes.**

5 Q. And then the -- it's also performed with a
6 recirculation of the dialkyl ether in the
7 1-alcohol; do you see that?

8 **A. Through recycling, yeah.**

9 Q. Okay. So at least here they're talking
10 about doing a lower temperature range of 255 to 290
11 and using a recirculation to improve conversion; is
12 that fair?

13 **A. Yes.**

14 Q. Is 255 to 290 in the normal range that you
15 see for dehydration reactions that we've looked at?

16 **A. Again, I'd have to go back and look. I**
17 **think that De Bruyn was a good example. We can**
18 **look that up and see what he did.**

19 Q. Yeah. If you want to take a look at
20 De Bruyn. And I believe De Bruyn at example 3 had
21 a reactor at 315 degrees C?

22 **A. Yes.**

1 Q. So a little bit lower, not a lot lower.

2 Would --

3 A. Yeah.

4 Q. Would a POSITA expect to see a difference
5 in reactivity between 290 and 315 degrees C?

6 A. Again, because their dehydration is
7 exothermic you're monitoring the temperature at
8 some point on the column or maybe multiple points
9 and running feed in and trying to maintain
10 somewhere around 290 or somewhere around 315 may
11 not be very different.

12 Q. Okay.

13 A. 255 is certainly lower. I mean, that's --
14 you may be running your feed in more slowly.

15 Q. So if you see a term in a patent, a term
16 of temperature that a reactor is being heated at,
17 and it's preceded by the word "about," if we say
18 we're running the reactor at about 315 degrees,
19 what does that term of approximation "about"
20 indicate to you or what would it indicate to a
21 POSITA, how many degrees on either side?

22 A. Mathematically if you say 315, well, that

1 five might be a significant figure or maybe it's
2 just plus or minus five, but probably not plus or
3 minus 20 mathematically. From the point of view of
4 running the reaction there's probably more wobble
5 in it for the reasons we just talked about, you
6 know, the rate of feed is -- the rate of heat loss
7 and all that sort of thing. You know, the air
8 conditioner kicks on in the other corner of the lab
9 and all of a sudden your heat loss is greater. You
10 know, actually running the reactor for an
11 exothermic reaction is a delicate art and you can
12 aim for a particular temperature range, but there
13 are those complexities.

14 Q. So would about 315 plus or minus
15 5 degrees?

16 A. It could be more than that.

17 Q. Plus or minus 10 degrees?

18 A. Yeah. It could be plus or minus
19 20 degrees depending on how fast this stuff is
20 flowing in. You say oh, it's slowing down, pick up
21 the rate, get my temperature back up again. So...

22 Q. Okay. And even at 315 degrees it's your

1 testimony that the exothermic nature of the
2 reaction could influence the temperature of the
3 reactor by up to 20 degrees?

4 **A. The temperature of the reactor will depend**
5 **on the flow rate. If the flow rate can be**
6 **maintained very consistently and the heat loss from**
7 **the reactor can be maintained very consistently,**
8 **you can maintain a very consistent temperature**
9 **through most of the procedure.**

10 **Q. Okay. And just to close the loop, when a**
11 **POSITA reads that a procedure of dehydration**
12 **reaction was performed at a temperature of 315,**
13 **what would be the variance that you would expect as**
14 **a POSITA?**

15 **A. Well, the POSITA would be motivated to**
16 **initially heat the reactor. And so now you've got**
17 **heat tapered around your reactor, whatever you're**
18 **doing, you're going to heat the reactor to get the**
19 **temperature. And then you start to run your**
20 **substrate in, temperature goes up, okay, turn the**
21 **heat off, keep running it in, get things under**
22 **control. And so on a single run the temperature**

1 might be highly variable. Once the POSITA's gained
2 experience with the reactor and with the flow rates
3 and all such things, then probably they can be more
4 consistent about maintaining the temperature.

5 Q. Okay. So I just want to know numerically
6 when you read something in a patent and you're a
7 POSITA, what would you expect in terms of the
8 variability? Is it 5 degrees?

9 A. The POSITA would be taught what they
10 would -- what they should be working to accomplish.
11 The POSITA would not necessarily know precisely how
12 to accomplish that from the description that is
13 given.

14 Q. Okay. How about for calcination
15 temperature? When we -- you know, calcination's
16 performed, it's obviously not -- well, I shouldn't
17 say it's obviously not exothermic, but I don't --
18 my understanding is that calcination -- if you're
19 doing a calcination of a powder or pellets of some
20 ceramic material or an oxide, metal oxide, that
21 shouldn't necessarily influence the temperature of
22 the oven or whatever it is you're heating it in to

1 any dramatic degree. If somebody reads that a
2 catalyst was calcined at 500 degrees C, would you
3 expect any variance in that temperature?

4 A. The POSITA would just set the oven at
5 500 degrees and put the catalyst in. Initially, of
6 course, it would be cooler because the process of
7 putting the catalyst in, you have water coming off
8 will cool it off, but eventually...

9 Q. Eventually you're going to get to
10 500 degrees C?

11 A. Eventually the oven will get the upper
12 hand and you'll have your 500 degrees.

13 Q. And that would be true in the range of 200
14 to, say, 600 degrees C?

15 A. Well, you would not usually do the
16 calcination over a temperature range except insofar
17 as the oven cools off and you put it in.

18 Q. Okay.

19 A. The -- you would choose a temperature near
20 the calcination. If your oven is at 600 degrees, I
21 very much doubt it would go do you think to 200
22 when you put the catalyst in.

1 Q. Sorry. I was referencing the fact that
2 we've -- for example, in Wright '451 I think a
3 calcination temperature of between 200 degrees C
4 and 600 degrees C is disclosed, for example, and if
5 you were to, say, run a calcination at a specific
6 temperature in that range, say 550 degrees C I
7 think is used in a lot of the examples, what would
8 a POSITA understand, that precisely 550 degrees C
9 was hit or some variance?

10 **A. Well, insofar as the oven is accurate in**
11 **its temperature control, they would just use the**
12 **550.**

13 Q. Okay.

14 **A. I doubt that a POSITA would put a**
15 **thermometer in it to check.**

16 Q. Right. And if a patent is disclosing
17 calcine the catalyst at about 550, what would be
18 the temperature variance on either side of 550 that
19 you would understand that to entail or encompass?

20 **A. If I were to put a guess of a temperature**
21 **control on the oven, if it did plus or minus 10, it**
22 **probably would be doing well.**

1 Q. Okay. So plus or minus 10 is generally
2 what you would expect?

3 A. No. Plus or minus 10 the oven would be
4 doing very well in its temperature control.

5 Q. Okay. Simply because of cycling and
6 heating?

7 A. Yes.

8 Q. Okay. So is it your testimony that about
9 550 would be about -- would be 550 plus or minus
10 10 degrees?

11 A. Not knowing the specifications on the
12 particular oven I would be willing to accept that.

13 MR. LUKAS: Okay. I don't have any other
14 questions for you today, Doctor. Thank you for
15 your time.

16 MR. MURPHY: I don't have anything.

17 MR. LUKAS: I think we're off the record,
18 then.

19 (Whereupon, at 3:17 p.m. the
20 taking of the instant
21 deposition ceased.)
22

1 CERTIFICATE OF REPORTER

2 I, Tina M. Alfaro, Certified Realtime
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11 I further certify that present on behalf
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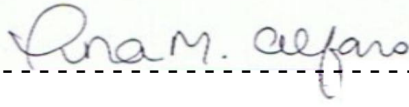
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