

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Symrise AG

Petitioner

v.

Inolex Inc.

Patent Owner

IPR2023-01035

U.S. Patent No. 10,995,048

Washington, D.C.

Tuesday, January 23, 2024

Deposition of DOUGLASS F. TABER, PH.D.,
called for examination by counsel for Inolex Inc. in
the above-entitled matter, taken at the offices of
Polzinelli, 1401 Eye Street, Northwest, Suite 800,
Washington, D.C., at 10:03 a.m. on Tuesday, January
23, 2024, and the proceedings being taken down by
stenotype and transcribed by KAREN YOUNG.

Henderson Legal Services

202-220-4158

www.hendersonlegalservices.com

1 APPEARANCES:

2 On Behalf of Symrise AG:

3 RYAN M. MURPHY, ESQ.

4 Polsinelli

5 1401 Eye Street, Northwest, Suite 800

6 Washington, D.C. 20005

7 rmurphy@polsinelli.com

8 (202) 626-8373

9

10 On Behalf of Inolex Inc.:

11 AARON LUKAS, ESQ.

12 Cozen O'Connor

13 1200 19th Street, Northwest

14 Washington, D.C. 20036

15 alukas@cozen.com

16 (202) 912-4800

17

18

19

20

21

22

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

C O N T E N T S

THE WITNESS:

DOUGLASS F. TABER

By Mr. Lukas..... 5

By Mr. Murphy..... 124

1

E X H I B I T S

2

TABER EXHIBIT NO.

PAGE NO.

3

1001 U.S. Patent No. 10,995,048 B2..... 15

4

1002 Declaration of Douglass F. Taber..... 10

5

1007 U.S. Patent Application Publication No.

6

2011/0196114 A1..... 95

7

1008 U.S. Patent Application Publication No.

8

US 2005/0065389 A1..... 73

9

1009 U.S. Patent Application Publication No.

10

US 2012/0238788 A1..... 109

11

1010 U.S. Patent No. 6,528,665 B1..... 122

12

1025 U.S. Patent No. 4,234,752..... 38

13

1026 German Patent Application, DE 3915493 A1. 45

14

1028 Article by Appleby et al..... 27

15

1029 Article by Komarewsky et al..... 32

16

1030 Excerpt from Textbook by L.G. Wade, Jr... 23

17

1035 International Publication No. W0

18

01/44145 A1..... 55

19

20

21

(EXHIBITS RETAINED BY COUNSEL)

22

- - -

1 P R O C E E D I N G S

2 (Exhibits were marked prior to the deposition.)

3 Whereupon,

4 DOUGLASS F. TABER,
5 residing at 568 North 23rd Street,
6 Philadelphia, Pennsylvania, called for
7 examination by counsel for
8 Inolex Inc. and having been duly
9 sworn by the Notary Public, was examined
10 and testified as follows:

11 - - -

12 MR. LUKAS: All right, so we're here today
13 in a matter relating to the inter partes review of
14 U.S. Patent Number 10,995,048. It's designated IPR
15 Number 2023-01035, Symrise AG, petitioner, V Inolex
16 Investment Corporation, patent owner. My name is
17 Aaron Lukas from the law firm Cozen O'Connor in
18 Washington, D.C. on behalf of Inolex Investment Corp.

19 MR. MURPHY: And I'm Ryan Murphy from
20 Polsinelli on behalf of Symrise.

21 EXAMINATION BY COUNSEL FOR INOLEX INC.

22 BY MR. LUKAS:

1 Q. All right, Doctor, can you please state
2 your full name for the record?

3 A. **Douglass Fleming Taber.**

4 Q. And where are you currently employed?

5 A. **I'm retired.**

6 Q. Retired. Can you please give us your home
7 address for the record?

8 A. **568 North 23rd Street, Philadelphia, 19130.**

9 Q. Okay. Dr. Taber, have you ever been
10 deposed before?

11 A. **Yes.**

12 Q. About how many times?

13 A. **More than ten.**

14 Q. Okay. When was the last time you sat for a
15 deposition?

16 A. **Before COVID, so probably five years ago.**

17 Q. Okay. So generally speaking, you
18 understand how this should go. Is that fair?

19 A. **Yes.**

20 Q. We have the court reporter writing down
21 what we say. It's really important we don't talk
22 over one another, so if you can let me complete my

1 question before you give an answer, that will be
2 helpful for her. Is that okay?

3 **A. Sure.**

4 Q. All right. Is there any reason you can't
5 give truthful testimony today?

6 **A. No.**

7 Q. Okay. We'll take breaks whenever you or I
8 or your counsel needs a break. Just let me know and
9 we can go off the record. I only ask that before we
10 go off the record, if there's a question pending,
11 that you answer it. Is that okay?

12 **A. Sure.**

13 Q. Okay. So you said you've been deposed
14 about ten times.

15 **A. Yes.**

16 Q. Last one was about five years ago?

17 **A. Something like that, yeah.**

18 Q. What was the subject matter of that
19 deposition?

20 **A. I would have to look at my records.**

21 Q. Okay. Was it a patent case?

22 **A. Probably, yes, but I -- you know, I would**

1 **have to look up my records of my legal cases to know.**

2 Q. Okay. And those other cases -- were those
3 -- that you were deposed in, were those also patent
4 cases?

5 A. **Most of them were. Not all.**

6 Q. Okay. What -- what cases have you worked
7 on that haven't been patent cases in the past?

8 A. **There's one case where two gentlemen with a
9 refinery had sold aviation fuel to the Air Force, and
10 it was the wrong color.**

11 Q. Okay. What did you do to prepare for
12 today's deposition?

13 A. **I read the background material and provided
14 some of the background material and discussed with
15 counsel the issues in the patent.**

16 Q. Okay, and you're referring to the
17 background material, are you referring to the
18 declaration you prepared?

19 A. **I prepared the declaration based on the
20 background material, yes.**

21 Q. Okay, so when were you first contacted
22 about this matter?

1 **A. About a year ago.**

2 Q. Okay, and have you worked with Polsinelli
3 in the past?

4 **A. No, I don't think so.**

5 Q. Okay. Who contacted you?

6 **A. Initially a representative from an agency**
7 **asking if I'd be interested in a case.**

8 Q. Okay, and you were interested in the case
9 obviously.

10 **A. Yes.**

11 Q. So when you were contacted, did you conduct
12 your own search for prior art?

13 **A. With regard to the dehydration, the**
14 **attorneys provided much of the prior art. With**
15 **regard to later materials, I found a great deal of**
16 **it.**

17 Q. Okay, so is it fair to say you were
18 provided some of the prior art and then did your own
19 search after that?

20 **A. Yes.**

21 Q. And was that mostly for background
22 material?

1 **A. Yes.**

2 Q. Okay. In preparation for today, did you
3 meet with any of the attorneys from Polsinelli?

4 **A. I met with Ryan.**

5 Q. Okay. For about how long?

6 **A. We had conversations of course all through**
7 **the preparation of the case. We met yesterday for**
8 **the preparation of the deposition today.**

9 Q. Okay. Did you review any documents in
10 preparation for today?

11 **A. Yes.**

12 Q. And those were cited in your declaration?

13 **A. Yes.**

14 Q. Okay. Since we have these already marked
15 as exhibits in the IPR, I don't think we're going to
16 introduce additional exhibit numbers today. I'll
17 just go with the exhibit number that's on the first
18 page. I think that will be easier for everybody.
19 I'm going to hand you what is marked as Symrise AG
20 Exhibit 1002. Do you recognize this document,
21 Doctor?

22 **A. I certainly recognize the first page.**

1 Q. Feel free to look through it.

2 A. Yeah, I'm sure it's all the same.

3 Q. So this is the declaration that you
4 prepared in support of the petition for inter partes
5 review; is that right?

6 A. Yes.

7 Q. If you could turn to page 72 --

8 A. Sure.

9 Q. It's going to be at the end of the written
10 section before your C.V. There you go.

11 A. Ah-ha.

12 Q. There is a date there. Do you see that?

13 A. Yes.

14 Q. What is that date?

15 A. June 7th, 2023.

16 Q. All right. So does this declaration
17 contain all the opinions that you intend to offer in
18 this matter?

19 A. The only concern is on page 34, where if
20 you see 66 --

21 Q. All right, 66.

22 A. Uh-huh.

1 Q. Yeah, I'm there.

2 A. Line 4 --

3 Q. Okay.

4 A. It should have said a bio-2-octanol would
5 dehydrate in both directions.

6 Q. Okay. So in other words, because a bio-2-
7 octanol's expected to have greater isomerization
8 during hydration would give this mixture --

9 A. No, nothing about isomerization. It just
10 provides an example.

11 Q. Okay.

12 A. You would expect the dehydration would give
13 this mixture --

14 Q. Okay.

15 A. -- because a bio-2-octanol would dehydrate
16 in both directions.

17 Q. Okay. Are there any other corrections that
18 you'd like to make to your declaration?

19 A. Not that I know of.

20 Q. Okay. So as you sit here today, that
21 declaration includes all the opinions you intend to
22 offer --

1 **A. Yes.**

2 Q. -- in this matter?

3 **A. On this patent.**

4 Q. And the patent that we're talking about is
5 U.S. patent number 11,095,048, right?

6 **A. Yes.**

7 Q. Is it okay if I refer to that as the '048
8 patent?

9 **A. Sure.**

10 Q. Okay, it'll make it easier for everybody.
11 So turning back -- we're going to be I think in this
12 declaration for a little while, and keep it handy,
13 but on pages 6 through 8, there's a table, and this
14 is in a section titled "Material Reviewed." Do you
15 see that?

16 **A. Right.**

17 Q. Does this document reviewed table that
18 extends from pages 6 through 8 of your declaration
19 include all the materials that you reviewed in
20 preparation of the declaration?

21 **A. There were other patents that we read, but
22 these looked like the most relevant to this case.**

1 Q. Okay, so it's fair to say in terms of the
2 opinions you offer, these were the documents you
3 relied upon; is that right?

4 A. Yes.

5 Q. And if we turn to paragraph 6 --

6 A. Page 6?

7 Q. -- which is right after that, page 8,
8 paragraph 6.

9 A. Okay.

10 Q. There's a section titled "Summary of My
11 Opinions." Do you see that?

12 A. Yes.

13 Q. And grounds 1 through 6 are provided in
14 that table. Do you see that?

15 A. Yes.

16 Q. Is that all of the -- does that summarize
17 your opinions as to the validity of the claims that
18 you have opinions on in this matter?

19 A. Yes.

20 Q. And I'll note that in grounds 1 through 6,
21 claims 1 through 6, 8 through 10 and 22 through 28
22 are the challenged claims; is that right?

1 **A. Yes.**

2 Q. So there's also claims 7 and 11 through 21.

3 **A. Let me check the numbers here, which**
4 **numbers are missing. Number 7 is missing, and yes,**
5 **11 through 21 are missing.**

6 Q. Right, so you're not offering any opinions
7 as to the validity of claims 7 and 11 through 21; is
8 that right?

9 **A. I would need to go back and look at those**
10 **claims, but my recollection is that they refer to the**
11 **details of catalyst preparation, and the answer is**
12 **no.**

13 Q. Okay. Okay, now I'm going to hand you what
14 is marked as Exhibit 1001, which is U.S. patent
15 number 10,995,048, and if you want to take a quick
16 look at claim 7 -- well, take a look at all the
17 claims, but in particular claims 7 and 11 through 21
18 if you want to refresh your memory there, and my
19 question is you're not offering any opinions as to
20 the validity of claims 7 or 11 through 21, correct?

21 **A. That is correct.**

22 Q. Turning back to your declaration, if you

1 want to -- you can keep the '048 patent handy for
2 reference, but I think we're mostly going to be in
3 your recollection. Withdrawn. Turning back to
4 paragraph 6 of your declaration, there's grounds 1
5 through 6 at -- on page 8. Do you see that?

6 **A. Yes.**

7 Q. Did you determine which prior art
8 references or combinations of prior art references
9 should be included in grounds 1 through 6?

10 **A. Did I do it? We worked together on this.**

11 Q. Okay. Did you review the petition that is
12 referenced -- that this -- sorry, withdrawn. Did you
13 review the petition in preparing your declaration?
14 And the petition, I mean the petition for inter
15 partes review in this matter.

16 **A. I don't recall. You'll have to show it to
17 me, whether I read it before or not.**

18 Q. Okay. You don't remember.

19 **A. No.**

20 Q. Okay. So I'd like to turn with you to page
21 19 of your declaration, paragraph 33, and the first
22 sentence of paragraph 33 says, "As of the priority

1 date of the '04 patent, in my opinion, all of the
2 chemical products and reactions claimed in the '048
3 patent were well known and had been well known for
4 decades." Do you see that?

5 **A. Yes.**

6 Q. So I just want to be clear, when you say
7 all the chemical products and reactions claimed in
8 the '048 patent, are you referring to all the claims
9 or just the challenged claims?

10 **A. This refers in particular to the**
11 **dehydration of 1-octanol to 1-octene. It also refers**
12 **to the process using gamma-alumina to do the**
13 **dehydration.**

14 Q. Okay. It wouldn't -- as you sit here
15 today, paragraph 33 doesn't refer to the subject
16 matter of claims 7 or 11 through 21. Is that fair?

17 **A. We are not specifically in our list**
18 **addressing 7 or 11 through 21, but insofar as 7**
19 **through 11 through 21 involve gamma-alumina catalysts**
20 **for dehydration, then the statement would be --**
21 **sentence 1 and 33 would include those.**

22 Q. Okay, let's take a look at claim 7 --

1 **A. Okay.**

2 Q. -- of the '048 patent. You have it there
3 in front of you?

4 **A. Sure.**

5 Q. And claim 7 recites the method according to
6 claim 6 wherein the fixed bed reactor is a fluidized
7 bed reactor. Do you see that?

8 **A. Yes.**

9 Q. Do you have an opinion as to the validity
10 of that claim?

11 MR. MURPHY: Objection.

12 THE WITNESS: I answer anyway?

13 MR. MURPHY: Yeah.

14 BY MR. LUKAS:

15 Q. Yeah, yeah. Sorry, just to be clear,
16 unless he instructs you not to answer, please go
17 ahead and answer the question.

18 **A. All right.**

19 Q. If you need clarification, obviously I can
20 provide some.

21 **A. So a fluidized bed reactor is a standard**
22 **way of proceeding for this sort of dehydration --**

1 Q. Okay.

2 A. -- as aptly indicated in the prior art.

3 Q. Okay, but you didn't offer an opinion as to
4 the validity of --

5 A. No.

6 Q. -- claim 7, did you?

7 A. If you're asking my opinion now, it's my
8 opinion.

9 Q. Is that opinion set forth anywhere in your
10 declaration?

11 A. No.

12 Q. Okay. And the declaration, just to be
13 clear, is -- contains all the opinions you intend to
14 offer in this case, correct?

15 A. Yes.

16 Q. Okay. What's your experience with
17 catalysts, Dr. Taber?

18 A. We've used catalysts and carried out
19 organic reactions all through my career. We've also
20 developed new applications of catalysts.

21 Q. Okay. Which catalysts have you worked
22 with?

1 **A. The list is very long.**

2 **Q. Okay.**

3 **A. You're aware of the transition elements.**

4 **Q. I am.**

5 **A. And we have worked with many of them.**

6 **Q. Okay. Have you ever used a catalyst for a**
7 **dehydration reaction?**

8 **A. Yes.**

9 **Q. Okay. Which one?**

10 **A. Well, there's more than one, but various**
11 **forms of proton source.**

12 **Q. Do any come to mind specifically?**

13 **A. The list is long, so the -- para toluene**
14 **sulphonic acid, hydrochloric acid, silica gel, acidic**
15 **anhydride, triflow -- triflic anhydride. Probably**
16 **keep this up for some time. I'm sorry, I should have**
17 **done that before.**

18 **Q. No problem.**

19 **A. Where are we on my list?**

20 **Q. Let me -- let me ask a --**

21 **A. Yeah.**

22 **Q. -- maybe a different question, a more**

1 specific question. Have you used any transitional
2 metal catalysts for a dehydration reaction?

3 **A. Tungsten. You'll excuse me. We're talking**
4 **about 50 years of organic chemistry experience, so**
5 **the -- there are probably others. I don't recall.**

6 Q. Okay. What -- what scale were those --

7 **A. I'm sorry, let me add one more.**

8 Q. Okay, go ahead.

9 **A. Alumina.**

10 Q. Alumina, okay. In terms of the -- the
11 scales that you have worked on, are those lab bench-
12 scale reactions?

13 **A. Mostly.**

14 Q. Okay.

15 **A. We have occasionally worked on kilogram**
16 **scale, but not usually.**

17 Q. Okay. Have you ever worked with a chemical
18 company or a third party that has hired you to
19 consult on reactions on a larger scale?

20 **A. No. I have talked with my company**
21 **colleagues about chemistry they're doing on a larger**
22 **scale --**

1 Q. Okay.

2 A. -- and consulted in that sense, but not as
3 a hired consultant.

4 Q. Okay. In your opinion, would a person of
5 ordinary skill in the art related to the subject
6 matter of the '048 patent have experience in
7 industrial chemistry or industrial processes?

8 A. Yes.

9 Q. Would that person of ordinary skill in the
10 art we're talking about have experience working at a
11 chemical company?

12 A. The person doing this chemistry as
13 described, probably yes.

14 Q. Okay. Have you ever worked to develop new
15 catalysts for reactions?

16 A. Yes.

17 Q. Okay, and if you can remember, what did
18 that work relate to?

19 A. There are many examples.

20 Q. Okay. Maybe -- maybe give me three or four
21 that jump out to you.

22 A. There's dirhodium tetracarboxylates, iron

1 **pentacarbonyl complexes, osmium complexes, copper**
2 **complexes. There are probably several others.**

3 Q. Okay. I'd like to turn to your declaration
4 at page 20 if you don't mind, and specifically
5 paragraph 35, and you state here that the dehydration
6 of 1-alcohols is one of the oldest catalytic
7 reactions. Do you see that?

8 A. **Yes.**

9 Q. And then at the end of that paragraph,
10 there's a citation to -- to Wade. Do you see that?

11 A. **Yes.**

12 Q. And that's a organic chemistry textbook,
13 right?

14 A. **Yes.**

15 Q. I'll hand you -- I have a copy of Wade
16 here. I'm handing you what's been marked as Exhibit
17 1030, which is a excerpt from an organic chemistry
18 textbook authored by L.G. Wade, Junior, eighth
19 edition. Do you use this book, Wade, or did you use
20 this book, Wade, in your classes?

21 A. **No.**

22 Q. Is there a reason you picked it as opposed

1 to a different organic chemistry textbook?

2 **A. Wade is a very good general organic**
3 **chemistry text for introductory organic chemistry.**

4 Q. The citation that you have at paragraph 35
5 of your declaration is to Wade at 312 to 314. Do you
6 see that? And I just wanted to turn there with you,
7 and I think the section you're referring to is at the
8 bottom of 312, section 7-10, alkene synthesis by
9 dehydration of alcohols. Do you see that?

10 **A. Yes.**

11 Q. Right, and it says here the dehydration --
12 and I'm looking at the paragraph at the bottom of
13 page 312 of Wade. Second sentence says, "Dehydration
14 can be forced to completion by removing products from
15 the reaction mixture as they form," and it discusses
16 distillation as one way to do that, right?

17 **A. Yes.**

18 Q. And then Wade goes through a discussion on
19 page 313 about different mechanisms.

20 **A. Yes.**

21 Q. There's a mechanism 7-4. Is it your
22 understanding that Wade in this section 7-4 is

1 discussing a liquid phase dehydration reaction?

2 **A. He does not comment on this being liquid**
3 **phase or gas phase.**

4 Q. Okay. So when we talk about step 1, I'm
5 looking at the key mechanism 7-4, protonation of the
6 hydroxyl group, and then step 2, the ionization to a
7 carbocation, and step 3 is deprotonation. What is
8 your understanding of whether this mechanism is
9 referring to a liquid phase or a gas phase reaction
10 or either, or both?

11 **A. This mechanism would hold for both liquid**
12 **phase and gas phase.**

13 Q. Okay, so liquid phase or gas phase, you're
14 going to say step 1, step 2 and step 3; is that
15 right?

16 **A. Yes, the species involved have been**
17 **simplified here.**

18 Q. Okay.

19 **A. But the overall concepts are the same.**

20 Q. Okay, so did you -- I'm sorry, did you have
21 anything else to add?

22 **A. No.**

1 Q. Okay. So if we're in -- if we're in
2 solution liquid phase, if we're in gas phase, it's
3 roughly the same, step 1, step 2, step 3, correct?

4 A. Yes.

5 Q. Okay.

6 A. Recognizing that step 1, 2 and 3 may be
7 fast enough that the intermediates have very limited
8 lifetime, but yes, conceptually, all three things
9 have to happen.

10 Q. Okay, and at the top of page 313, Wade is
11 discussing the acid catalyzed -- well, giving an
12 example of phosphoric acid or I think also sulfuric
13 acid as being the acid catalyst. Do you see that?

14 A. Yes.

15 Q. When we're talking about a solid phase
16 catalyst like alumina, does that also function as an
17 acid catalyst?

18 A. Yes.

19 Q. And would that also proceed by the same
20 mechanism?

21 A. Again, the species involved are probably
22 more complex than this, but the concepts are the

1 same.

2 Q. So when you talk about the species being
3 more complex, what is that referring to?

4 A. It would be very difficult, given the
5 velocity of the reactions, to discern the specific
6 bonding between the alumina catalyst and the
7 substrate as the reaction proceeded, but
8 conceptually, this is what is going on in the
9 dehydration.

10 Q. Okay, that's fine. I'm going to hand you
11 what is marked as Exhibit 1028, which is -- it's a
12 journal article by a W.G. Appleby, and it is dated on
13 the second page August 15th, 1944 as being received,
14 and published in November of 1944. Do you recognize
15 this document, Doctor?

16 A. Yes.

17 Q. And did you consider this document,
18 Appleby, in forming your opinions?

19 A. Yes.

20 Q. Now, if we look at Appleby in the very
21 first sentence in the introduction, he says, "The
22 vapor phase dehydration of alcohols over activated

1 alumina has been one of the standard methods for the
2 preparation of olefins of low molecular weight." Do
3 you see that?

4 **A. Yes.**

5 Q. Okay. What is alumina?

6 **A. Alumina's aluminum oxide.**

7 Q. Is -- and when we're talking about aluminum
8 oxide, we're talking about Al₂O₃; is that right?

9 **A. Yes.**

10 Q. Are they always present in that
11 stoichiometric ratio of two to three?

12 **A. In the bulk alumina, yes. On the surface,**
13 **there may be many other species.**

14 Q. Okay. Is there any protonation on the
15 surface?

16 **A. There's probably water on the surface and**
17 **an availability of protons, yes.**

18 Q. Okay. Are you familiar with the term
19 "activated alumina"?

20 **A. Yes.**

21 Q. What is activated alumina?

22 **A. Alumina is often activated by drying.**

1 Q. And how does drying activate the alumina?

2 A. **Dry and remove water, creating a more**
3 **active form of the alumina.**

4 Q. Okay, and how is that drying typically
5 performed?

6 A. **Often by -- well, by heating often with a**
7 **flow of an inert gas.**

8 Q. Okay. Is there a specific temperature or
9 temperature range that's typically used to activate
10 alumina?

11 A. **The temperature is -- time and temperature**
12 **used to activate alumina are empirical.**

13 Q. Okay. How would you determine whether the
14 alumina is active?

15 A. **By running the reaction.**

16 Q. Okay. Have you used alumina, activated
17 alumina for any of your reactions that you've
18 performed?

19 A. **We have certainly used it. I'm trying to**
20 **remember specific applications. They don't come**
21 **readily to mind.**

22 Q. Okay. In your opinion, would a person of

1 ordinary skill in the art understand how to use
2 alumina or active alumina?

3 **A. A person of ordinary skill in the art faced**
4 **with this particular task would be well aware of the**
5 **literature and follow that precedent.**

6 Q. Okay, and would a person of ordinary skill
7 in the art attempting to dehydrate a 1-alcohol to
8 form a 1-alkene, would that person use alumina or
9 activated alumina?

10 **A. The -- that person would have been informed**
11 **reading the literature that you need to activate the**
12 **alumina before you use it.**

13 Q. Okay. If we look at the top of column 2 at
14 page 1938 of Exhibit 1028, there's -- the first full
15 sentence there, and it's a very small font, but I
16 believe it says the reaction 2 was supported in a
17 vertical tube furnace held in the temperature range
18 380 to 400 degrees. Do you see that?

19 **A. Yes. We presume those are degrees C, but**
20 **it does not say so.**

21 Q. Right, and we can assume that that was --
22 that's degrees Celsius, right?

1 **A. Like I said, we don't know, but anyway --**

2 Q. Is it your understanding that that refers
3 to degrees Celsius?

4 **A. That would be a reasonable assumption, but**
5 **we don't really know.**

6 Q. Okay. Do you think a person of ordinary
7 skill in the art would understand that to be degrees
8 Celsius?

9 **A. A person of ordinary skill in the art would**
10 **wonder and do the experiment, see what worked.**

11 Q. Okay. That temperature range, is that a
12 pretty typical temperature range to use activated
13 alumina at for this type of reaction?

14 **A. Given the literature background, there's a**
15 **somewhat broader range that people have used.**

16 Q. And what is that broader range, if you
17 remember it?

18 **A. I don't remember in detail, but the -- we'd**
19 **have to go back and look at the actual prior art and**
20 **see, but my recollection is the range was somewhat**
21 **broader than that.**

22 Q. Okay. I'm going to hand you what's marked

1 as Exhibit 1029, which is also a journal article,
2 first author is a V.I. Komarewsky,
3 K-O-M-A-R-E-W-S-K-Y, and it has a publication date of
4 April 1945. Do you recognize this document?

5 A. Yes.

6 Q. Did you rely on this document in forming
7 your opinions?

8 A. Yes.

9 Q. Okay. If you look about -- in the first
10 column on the first page, 557 there, there's a
11 reference to the recent publication of Appleby. Do
12 you see that?

13 A. Yes.

14 Q. Is your understanding that that's referring
15 to the Exhibit 1028 we just looked at?

16 A. Yes.

17 Q. And if we go on to the next line, next
18 sentence, sorry, of column 1, it says, "We found that
19 1-hexanol and 1-octanol when dehydrated over aluminum
20 oxide catalyst yield as a main product 1-hexene and
21 1-octene, respectively." Do you see that?

22 A. Yes.

1 Q. And here there's -- in column 2, there's a
2 discussion of the catalyst that was used. Do you see
3 that?

4 A. Yes.

5 Q. There's a paragraph titled "Catalyst," and
6 it says, "Alumina catalyst was prepared by
7 precipitation of aluminum hydroxide from a clear
8 solution of sodium aluminate by ammonium chloride."
9 Do you see that?

10 A. Yes.

11 Q. And they say that it's aluminum hydroxide,
12 not necessarily alumina. What is -- what is your
13 understanding if -- of that catalyst? Is it aluminum
14 hydroxide or is it alumina?

15 A. People speak of activated alumina, and they
16 made the activated alumina by drying this
17 precipitate, and they talk about under a stream of
18 dry nitrogen at 350 degrees. The -- the aluminum
19 hydroxide, aluminum hydroxide.

20 Q. Right, so the alumina -- aluminum hydroxide
21 was precipitated and then dried --

22 A. To make alumina.

1 Q. -- to make alumina. Is that your
2 understanding?

3 A. Yes.

4 Q. And did that -- is it also your
5 understanding that that drying at 350 degrees
6 resulted in activated alumina?

7 A. Yes.

8 Q. And would a person of ordinary skill in the
9 art have that same understanding?

10 A. Yes.

11 Q. And is it also -- is it your understanding
12 that the aluminum hydroxide catalyst described in
13 Komarewsky would be equivalent to the alumina
14 catalyst that we looked at in Appleby?

15 A. I'm not sure the question's phrased quite
16 appropriately. The -- do you mean to say that the
17 alumina catalyst described in Komarewsky is the same
18 as the alumina catalyst in Appleby?

19 Q. Yes, let me -- let me ask the question
20 again --

21 A. Okay.

22 Q. -- just so we have it clean. Is it your

1 understanding, Doctor, that the alumina catalyst
2 described in Komarewsky is the same or substantially
3 equivalent to the alumina catalyst in Appleby?

4 **A. My expectation is they were similar. I**
5 **don't know if they're precisely the same.**

6 Q. Okay, but they're both alumina.

7 **A. Yes.**

8 Q. And they're both activated alumina.

9 **A. Yes.**

10 Q. And -- and if we look at -- turning back to
11 column 1 of page 557 of Komarewsky, under the
12 experimental part, do you see that?

13 **A. Yes.**

14 Q. There's a -- a sentence at the end of that
15 paragraph saying alcohols were passed over the
16 catalyst at a constant rate at 350 degrees. Do you
17 see that?

18 **A. Yes.**

19 Q. And again, it doesn't specify Fahrenheit or
20 Celsius.

21 **A. That's correct.**

22 Q. Would you expect to see a difference in

1 terms of the -- how the reaction proceeded at 350
2 compared to 380 degrees?

3 A. Assuming they're the same units of degree
4 --

5 Q. Yeah.

6 A. The -- both reactions seem to have been
7 successful.

8 Q. Okay, so would a person of ordinary skill
9 in the art expect there to be a difference between
10 the 350 degree reaction temp described in Komarewsky
11 and the 380 to 400 degree reaction temp described in
12 Appleby?

13 A. There are many variables that are not
14 mentioned in these articles, what was the mass of the
15 aluminum oxide, the activated alumina that was used
16 as a catalyst, what were the dimensions of this
17 tubular heater. We do know that it was 40
18 centimeters long and 12 millimeters in diameter. Was
19 that inside diameter or outside diameter? So it's a
20 little difficult to compare the two precisely because
21 we really don't know flow rates, all these things.
22 We know they're both successful.

1 Q. Okay. So what are the variables in terms
2 of the -- you mentioned flow rate, you mentioned the
3 diameter of the reaction vessel or tube.

4 A. Yes.

5 Q. What -- what else can be controlled by a
6 chemist who's running this type of reaction?

7 A. Temperature, purity of starting alcohol are
8 two that come immediately to mind.

9 Q. Yeah.

10 A. Carrier gas could be important too.

11 Q. The type of carrier gas?

12 A. Well, carrier gas or not, and then the type
13 of carrier gas.

14 Q. Okay. How about pressure?

15 A. Pressure's important too, sure.

16 Q. Okay. So would a person of ordinary skill
17 in the art reviewing Komarewsky -- would you
18 understand that the mechanism for the dehydration
19 reaction here is the same that's described in Wade?

20 A. Yes. Wade was not written yet.

21 Q. Right, right, this was from 1944 and 1945,
22 the Appleby and Komarewsky, right? Yeah. Okay, you

1 can put Komarewsky aside for now. All right, I'm
2 going to hand you what's marked as Exhibit 1025,
3 which is U.S. patent number 4,234,752, titled
4 "Dehydration of Alcohols." First named author is a
5 Yulin, Y-U-L-N, Wu, W-U. Do you recognize this
6 document, Doctor?

7 **A. Yes, this is our Exhibit 1025.**

8 Q. All right, and did you consider Exhibit
9 1025 in forming your opinions?

10 **A. Yes.**

11 Q. And if you look at the top right-hand
12 corner, it has a publication date of November 18th,
13 1980. Do you see that?

14 **A. Yes.**

15 Q. So that's more than 30 years after the
16 Appleby and Komarewsky references we looked at,
17 right?

18 **A. Yes, and well before the patent in**
19 **question.**

20 Q. Right, right. Now, if we look at -- and is
21 it okay if I refer to this document as Wu?

22 **A. Sure.**

1 Q. Okay, so if we turn to column 2 of Wu,
2 around line 23, it talks about a catalyst, gamma-
3 alumina, is well known and readily available
4 commercially. Do you see that?

5 **A. Yes.**

6 Q. And then if you continue on in that same
7 paragraph, it says, "Since the surface activity of
8 gamma-alumina available from some sources can be
9 different from that of others, it may be desirable to
10 treat the gamma-alumina with a suitable activity-
11 altering agent to obtain a catalyst with the desired
12 surface activity," and then the next sentence says,
13 "For example, if excess acidic sites were available
14 on the alumina surface, excessive isomerization of
15 desired product to undesired product may result." Do
16 you see that?

17 **A. Yes.**

18 Q. So what is -- what is your understanding of
19 the reference to excessive isomerization of desired
20 product, undesired product as it's used here?

21 **A. Go to my report, on page 23, I talk about**
22 **the isomerization being acid catalyzed.**

1 Q. Right.

2 A. And the isomerization converts to 1-octene
3 2 -- to the undesired perhaps 2-octene.

4 Q. Okay.

5 A. So if your object is to make 1-octene, you
6 want to minimize the acid isomerization.

7 Q. Okay, and so Wu is -- is basically teaching
8 that it may -- the activated alumina -- withdrawn.
9 Sorry. Wu is teaching that gamma-alumina may be too
10 acidic, and it may result in isomerization reactions
11 that produce 2-octene or basically 2-alkenes if
12 you're talking about alkenols, right?

13 A. If you're talking about alkenols, then the
14 undesired byproduct would be the 2-alkene, yes. He's
15 talking about gamma-alumina from some sources, some
16 commercial sources, and gamma-alumina from different
17 commercial sources or even from the same commercial
18 source can vary in its composition, and that it
19 sometimes needs to be treated appropriately to make
20 it into the right sort of catalyst.

21 Q. Okay, and at the end of that paragraph, it
22 says, "Acidic sites" -- and this is column 2 around

1 line 23. "Acidic sites on the alumina surface may be
2 neutralized by treatment of the alumina with aqueous
3 potassium hydroxide or aqueous sodium hydroxide,
4 following by washing with water and subsequent
5 drying." Do you see that?

6 **A. Yes.**

7 Q. So what is the -- the base, the potassium
8 or sodium hydroxide, doing to the surface of the
9 alumina?

10 **A. The hydroxide can react with protons on the**
11 **surface to make water and thereby remove those**
12 **protons from the surface.**

13 Q. Okay, so it's removing protons from the
14 surface of the alumina?

15 **A. Yes.**

16 Q. Okay, and --

17 **A. It's removing protons from the alumina. It**
18 **may not just be strictly on the surface. It may get**
19 **into the -- into the alumina.**

20 Q. Okay. It may penetrate into the alumina --

21 **A. Yes.**

22 Q. -- and actually react internally as well?

1 **A. Yes.**

2 Q. Okay. And does the -- does a reagent like
3 a 1-alkenol, does it also have the ability to
4 penetrate into the alumina and undergo a reaction
5 there?

6 **A. I would expect that the 1-alkenol would be**
7 **reacting as it approached the alumina. Could it go**
8 **in somewhat into the alumina? Perhaps.**

9 Q. Okay. And if we look in the same column of
10 Wu, column 2 around line 50, there's a description of
11 preferred temperature ranges. Do you see that?

12 **A. Yes.**

13 Q. And it says generally, the temperature
14 range of 200 to 500 degrees C is suitable, and it's
15 currently preferable to employ temperatures in the
16 range of 300 to 450 C; is that right?

17 **A. Yes.**

18 Q. And also in the next paragraph, there's
19 also a discussion of pressure. Do you see that?

20 **A. Yes.**

21 Q. And it discloses -- Wu is disclosing
22 pressures in the range of 100 to 700 kilopascals --

1 **A. Yes.**

2 Q. -- are contemplated as desirable. Is that
3 -- and just so we're clear, that is pressures that
4 are greater than atmospheric pressure; is that right?

5 **A. I really don't recall how much a kilopascal**
6 **is, so --**

7 Q. So in terms of the -- you recall we looked
8 at Appleby and Komarewsky, which used activated
9 alumina, right?

10 **A. Yes.**

11 Q. And now we're looking at Wu, which is
12 teaching take the alumina and treat it with a base.
13 Are the overall mechanisms of dehydration the same
14 between Appleby and Komarewsky and Wu?

15 **A. The general -- the general somewhat**
16 **simplified mechanism is the same.**

17 Q. Okay. Would the -- would the alumina
18 catalyst that's described in Wu, the base treated
19 catalyst, would that still be considered activated?

20 **A. Yes, they specifically say in 30 that they**
21 **dry -- I'm sorry, in 35, that they dry after they**
22 **wash it.**

1 Q. Right, and so you're referring to I think
2 column 2 line 35?

3 A. Yes.

4 Q. Okay, so that drying is going to create an
5 activated alumina catalyst.

6 A. Yes.

7 Q. Is any dried catalyst -- any dried alumina
8 catalyst considered to be activated?

9 A. Yes, activated is a relative term.

10 Q. Okay.

11 A. And so sufficiently activated is a
12 different question.

13 Q. Okay, so -- and by sufficiently activated,
14 you mean sufficiently activated to do the reaction as
15 the chemist would desire it to be done.

16 A. Yes. This is why people talk about time
17 and temperature for activation.

18 Q. Okay. Is there any way to know without
19 doing the experiment whether a specific time and
20 temperature is sufficient to activate the alumina?

21 A. Starting with the same batch of alumina, if
22 treating a portion of it in a certain way led to the

1 **appropriate activated catalyst, it probably would**
2 **again with another portion of that same batch of**
3 **alumina.**

4 Q. Okay. Would you need to do that experiment
5 on any new batch of alumina that you were using to
6 ensure that your time and temperature was sufficient
7 to activate it?

8 **A. Probably.**

9 Q. Would a person of ordinary skill in the art
10 understand that?

11 **A. Yes.**

12 Q. All right, I'm going to hand you another
13 document. You can put Wu aside for now, Doctor.
14 This is a document marked as Exhibit 1026, 1026. It
15 is a German published patent application with a
16 number DE 3915493 A1. I believe the filing date is
17 in December of 1989, and the publication date is in
18 November of 1990. Sorry, I believe the filing date
19 is in May of 1989, publication date is November 1990,
20 and the first named inventor is a Voeste,
21 V-O-E-S-T-E, a Theodore Voeste. Do you see that?

22 **A. Yes.**

1 Q. Is it okay if I refer to this as Voeste?

2 A. Sure.

3 Q. Okay. Do you recognize this document?

4 A. Yes.

5 Q. And you considered Exhibit 1026 in forming
6 your opinions in this matter?

7 A. Yes.

8 Q. And so Voeste published in 1990; is that
9 right?

10 A. Yes, I think you just said that.

11 Q. And that's about ten years after the Wu
12 reference we just looked --

13 A. Yes.

14 Q. -- at, right? And if we can -- so I don't
15 know if you read German, Dr. Taber, but there is a
16 translation of this document beginning around I
17 believe it's page 6 of the document.

18 A. I do not declare myself an expert in
19 reading German.

20 Q. Yeah, I will stick with the English
21 translation as well. If we could go to I believe
22 it's -- so the numbers -- I'm referring to the number

1 on top of the English translation here --

2 A. Yes.

3 Q. -- Exhibit 1026, and we're going to be on
4 page 2, beginning around line 5. Do you see that?

5 A. Yes.

6 Q. And so there's a paragraph, the first full
7 paragraph of page 2 that starts with, "The
8 dehydration of fatty alcohols in a vapor phase over
9 alumina catalyst." Do you see that?

10 A. Yes.

11 Q. And this is a reference to a couple prior
12 art publications, one published in 1972 and another
13 in December of 1972. Do you see that?

14 A. Yes.

15 Q. And beginning around line 11, he says,
16 "Where alcohols, and more particularly, hexanol,
17 heptanol or octanol were dehydrated," so that's what
18 I guess is disclosed in this Indian Journal of
19 Technology, right?

20 A. Yes.

21 Q. And he goes on --

22 A. I have not read the Indian Journal of

1 **Technology article, so --**

2 Q. I was going to ask you that, if you had
3 read that. So you didn't -- you did not search for
4 the Indian Journal of Technology referenced here?

5 A. **I do not recall doing that. I don't know.**

6 Q. Okay. And how about the other one, the
7 Houben-Weyl?

8 A. **Weyl, no, I did not read the Houben-Weyl**
9 **description.**

10 Q. Okay. So this -- this published
11 application goes on to say, "Operation in this case
12 takes place using an alumina catalyst at temperatures
13 of about 350 to 400 degrees C," and the last sentence
14 says, "To increase the yield of alpha-olefins, the
15 catalyst is doped with alkali metal or alkaline earth
16 metal." Is that right?

17 A. **Yes.**

18 Q. Now, the question I have for you is what
19 would -- how would doping with an alkali metal or
20 alkaline earth metal increase the yield of the
21 alpha-olefin provided by an alumina catalyst.

22 A. **A lot of this is empirical experience that**

1 would, again, looking back through the supporting
2 documentation we reference here, this often comes up.
3 We've spoken about washing with sodium hydroxide or
4 potassium hydroxide. People thought by using calcium
5 salts, barium salts, the -- my speculation is that
6 there are particularly active areas on the alumina
7 catalyst that promote isomerization, and that these
8 salts serve to deactivate those sites --

9 Q. Okay.

10 A. -- therefore, making a more user friendly
11 catalyst.

12 Q. Okay. By user friendly, you mean it
13 provides more of the alpha-olefin as opposed to the
14 undesired side products that you may get.

15 A. Yes.

16 Q. Is that right? And the alkali metal or
17 alkaline earth metal, those would be more basic than
18 the alumina; is that right?

19 A. The alkali metal and alkaline earth metals
20 like to form bonds to oxygen, and so one could
21 imagine them sticking to the alumina, but that's only
22 in imagination. I don't have any surface study to

1 **show that.**

2 Q. Okay. So in the next paragraph, I think
3 Voeste is now turning to the invention of this patent
4 application and talking about what they found, which
5 is that -- and I'm looking at the second sentence.
6 In accordance with the invention, this, which is high
7 conversion and good selectivity, is accomplished by
8 the addition to the fatty alcohol prior to the
9 dehydration of 20 to 300 parts per million of
10 ammonia, and by the implementation of the dehydration
11 at a pressure below the atmospheric pressure and at
12 temperatures in the range of 280 to 300 C over a
13 catalyst, which consists of at least 99.8 percent
14 gamma-aluminum oxide; is that right?

15 A. **Yes.**

16 Q. So is it -- is it your understanding that
17 Voeste is teaching that rather than treat the alumina
18 with a base, you can actually add ammonia to the
19 reagent stream, the alkenol that's being reacted?

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

21 Q. Okay. And Voeste's disclosing a
22 temperature of 280 to 300 degrees C, right?

1 **A. Yes.**

2 Q. And that's a little bit lower than some of
3 the temperatures we looked at in Appleby, Komarewsky
4 and Wu, right?

5 **A. Yes, although again, we don't know the**
6 **dwell time on the catalyst.**

7 Q. Right. If we go to the next paragraph,
8 Doctor, Voeste discloses that with the catalyst,
9 which is known per se. I guess everybody -- he's
10 saying look, everybody knows about gamma-alumina,
11 right?

12 **A. I'm sorry, where are you?**

13 Q. I'm at page 2, line 29, the next paragraph
14 down.

15 **A. Okay.**

16 Q. "With the catalyst, which is known per se,"
17 do you see that?

18 **A. Yes. I'm not sure what that means, but I**
19 **see it.**

20 Q. Okay. The catalyst is referring to the
21 gamma-aluminum oxide, right?

22 **A. Yes, or the -- the gamma-aluminum oxide**

1 **have been treated, however it was treated, yes.**

2 Q. Okay. Well, he doesn't actually say that
3 the gamma-aluminum oxide is treated at all, does he?

4 A. **He does not. We don't know what he did.**

5 Q. Okay. He just says that it's 99.8 percent
6 --

7 A. **Yeah, but we don't know how he treated it**

8 --

9 Q. Okay.

10 A. **-- before he used -- before he used the**
11 **ammonia.**

12 Q. Right, so we don't know if it was treated
13 with a surface treatment or if it was heated or --

14 A. **That's right.**

15 Q. -- any of that stuff, right?

16 A. **There's no information.**

17 Q. Okay, but he says that you can achieve a
18 conversion of at least 98 percent, right?

19 A. **That's what he says.**

20 Q. Okay, and with the addition of ammonia, the
21 alpha selectivity would amount -- sorry, withdrawn.
22 Without the addition of ammonia, the alpha

1 selectivity would amount to about 90 percent. Do you
2 see that?

3 **A. Yes.**

4 Q. So he's -- is he saying -- do you
5 understand that he's saying that with the same
6 catalyst, he gets about a 90 percent conversion to
7 the alpha-olefin if there's no ammonia, correct?

8 **A. Yes, but ten percent byproducts.**

9 Q. Okay. And then when you add the ammonia,
10 that goes up to 98 percent, right?

11 **A. Yes, and reduces the amount of byproducts.**

12 Q. Okay. If we could turn back to your
13 declaration, which I believe is Exhibit 1002, I have
14 a question for you there. And this is at page 25 if
15 you don't mind, Doctor. So page 25, paragraph 45,
16 you say, "Before the priority date of the '048
17 patent, a person of ordinary skill in the art would
18 understand that varying one parameter of a reaction
19 design might influence another parameter." Do you
20 see that?

21 **A. Yes.**

22 Q. And then you give an example, "Optimizing

1 for yield might require more energy consumption,
2 e.g., higher temperatures," and my question here is
3 when you say optimizing for yield, does that refer to
4 the overall yield of alkenes that are produced or the
5 overall desired product that is produced?

6 **A. Usually a POSITA will be motivated by the**
7 **desired product.**

8 Q. Okay, so that's reference to the -- the
9 optimizing for yield of the desired --

10 **A. Yes.**

11 Q. -- 1-alkene. Is that fair?

12 **A. Yes.**

13 Q. Okay. And is it -- is it your
14 understanding that a person of ordinary skill in the
15 art would understand that increasing the temperature
16 of a dehydration reaction leads to a predictably
17 higher yield of the desired alpha-olefin?

18 **A. No, the -- raising the temperature may**
19 **increase the yield, it may decrease the yield.**
20 **Depends how much you raise the temperature. Clearly**
21 **there's -- a lot of experimentation would have to go**
22 **on to optimize --**

1 Q. Okay.

2 A. -- the yield of the desired product.

3 Q. So for a given catalyst, you'd have to
4 actually go and do the experiment to find out if it's
5 going to increase the yield as you increase
6 temperature; is that right?

7 A. Yes.

8 Q. Okay, I'm going to hand you now what's been
9 marked as Exhibit 1035. This is a published
10 international patent application. The publication
11 number is WO 01 slash 44145 A1, and it has a
12 publication date of June 2001. Do you recognize this
13 document?

14 A. Yes.

15 Q. And did you consider Exhibit 1035 in
16 forming your opinions?

17 A. Yes.

18 Q. I'm going to -- I don't know how to
19 pronounce the first inventor's name with a double I
20 and double T, and Finnish is not my thing, so I'm
21 just going to refer to this, to the '145 publication.
22 Is that okay?

1 **A. Sure.**

2 Q. All right. So this '145 publication is
3 from 2001, right?

4 **A. It's filed 2000, and published 2001, yes.**

5 Q. Okay, which is about ten years after the
6 Voeste publication we just looked at, right?

7 **A. Yes.**

8 Q. And if we -- this is a long abstract. I
9 don't want to go through the entire thing with you,
10 but if you look at the bottom of page 1 of the '145
11 publication, the abstract starts with, "The invention
12 relates to a process for producing olefins comprising
13 the following steps." So A is oxidation of an
14 aliphatic hydrocarbon component to give an alcohol.
15 Do you see that?

16 **A. I'm sorry, no. We're on page 1?**

17 Q. Sorry, the -- sorry, the front -- the front
18 cover page of the document, so the abstract --

19 **A. Oh, okay.**

20 Q. -- is at the bottom there.

21 **A. Thank you.**

22 Q. All right, withdrawn. So in the abstract,

1 the '145 publication states, "The invention relates
2 to a process for producing olefins," and lists
3 several steps. A is oxidation of an aliphatic
4 hydrocarbon to give the corresponding alcohol, right?

5 **A. Yes.**

6 Q. And that's followed by dehydration of the
7 alcohol to produce the corresponding olefin, right?

8 **A. Yes.**

9 Q. And if you could turn with me now inside
10 the '145 publication, Doctor, the first -- sorry,
11 page 3, around line 9, there's a paragraph that
12 starts, "As is known." Do you see that?

13 **A. Page 3 line 9?**

14 Q. Yeah.

15 **A. Yes.**

16 Q. And the 3 is at the top --

17 **A. Yes.**

18 Q. -- the top of the page, okay. And it says,
19 "As is knows, olefins may be produced by dehydrating
20 alcohols." Do you see that?

21 **A. Yes.**

22 Q. And in this reaction, which is carried out

1 at atmospheric pressure and a temperature between 100
2 and 350 degrees C, the alcohol gives olefin and
3 water, right?

4 **A. Yes.**

5 Q. And it talks about aluminum oxide catalyst
6 has been used for a long time to do this reaction,
7 right?

8 **A. Yes.**

9 Q. And then it talks about some other
10 catalysts such as zeolites, magnesium sulfate, other
11 -- other catalysts that are also known to do this
12 reaction, right?

13 **A. Yes.**

14 Q. And then it gives the example of -- another
15 example of titanium oxide with aluminum oxide, right?

16 **A. Yes.**

17 Q. So there's a lot of different catalysts
18 that are known to convert 1-alcohols to alpha-
19 olefins, right?

20 **A. This paragraph specifically speaks about**
21 **dehydrated alcohols in general.**

22 Q. Okay.

1 **A.** And so it could be a primary or secondary,
2 **tertiary. We don't know.**

3 **Q.** Okay. Okay, fair enough. So it -- it --
4 regardless though, the mechanism is going to be the
5 same, right?

6 **A.** **Yes.**

7 **Q.** Okay. And if we go to page 4, the next
8 page, the second full paragraph -- yeah, the second
9 -- maybe -- sorry, beginning around line 15.
10 Withdrawn. It says, "Problems related to the
11 processes of the prior art for producing alpha-
12 olefins from alcohols and the catalysts used therein
13 include the impurities of the alpha-olefin products
14 if 1- or 2-alcohols are used as starting materials
15 and the poor selectivity of the current gamma-alumina
16 oxide catalyst modified with sodium." Do you see
17 that?

18 **A.** **Yes.**

19 **Q.** So the '145 publication is saying there's
20 still issues with the selectivity of a sodium-
21 modified gamma-aluminum catalyst, right?

22 **A.** **So they say, although they're not specific**

1 **about how they prepared that catalyst, but --**

2 Q. Right.

3 A. **In general, they're saying it's not as good**
4 **as it might be.**

5 Q. Yeah, and I guess I just had a question
6 generally. So a person of ordinary skill of the art
7 reviewing this '145 publication, when they see a
8 description of poor selectivity, what is your
9 understanding of what a person of ordinary skill in
10 the art would view as being poor selectivity for that
11 reaction?

12 A. **Let me answer the -- that with a different**
13 **statement, that a person of ordinary skill in the art**
14 **would look for prior art and be aware of prior art**
15 **that worked to give the result that he or she wanted,**
16 **and vague comments about things don't work well would**
17 **be less useful.**

18 Q. Okay, so is it your understanding that a
19 description of -- of I guess sodium-treated gamma-
20 aluminum catalyst as giving poor selectivity without
21 any specifics wouldn't dissuade you or a person of
22 ordinary skill in the art from using that type of a

1 catalyst; is that right?

2 **A. That's correct, if there's other evidence**
3 **that it works well.**

4 Q. Okay, and I think we saw some evidence from
5 I believe it was the Wu patent, correct, about --
6 about sodium-treated --

7 **A. Yes.**

8 Q. -- gamma-alumina?

9 **A. Yes.**

10 Q. Okay. And then in the next sentence in
11 that same paragraph of the '145 publication, it says,
12 "Some of the drawbacks of the commercial zirconium
13 oxide catalysts are its poor mechanical strength and
14 low activity relative to the dehydration of alcohols
15 at lower temperature." Do you see that?

16 **A. Yes.**

17 Q. And so if we turn to page 5 of the '145
18 publication, the next page, Doctor, and there's --
19 the first full paragraph, or maybe it's -- so
20 beginning around line 4, "An object of the
21 invention," do you see that?

22 **A. Yes.**

1 Q. And so beginning around line 8, it says,
2 "An object of the invention is further to provide a
3 process for oxidizing aliphatic hydrocarbons to give
4 1- or 2-alcohols. Another object of the invention is
5 provide a process for dehydrating aliphatic 1- or
6 2-alcohols to provide corresponding alpha-olefins,"
7 right?

8 A. Yes.

9 Q. And if we look -- sorry, if we go to page 8
10 of the document -- I lost my track there. Page 8 of
11 the '145 publication, beginning around line 11, the
12 '145 publication states, "It's been found that
13 alpha-olefins may be selectively produced by
14 dehydrating primary or secondary alcohols by means of
15 an active and alpha-selective catalyst comprising
16 zirconium oxide on aluminum oxide," right?

17 A. Yes.

18 Q. And so the '145 publication is saying
19 gamma-alumina had its problems, zirconium oxide had
20 its problems. We've now combined them to create a
21 new catalyst. Is that fair?

22 A. Yes.

1 Q. Have you ever used a mixture of zirconium
2 oxide and alumina to do a catalytic reaction?

3 A. No. I've used zirconium tetrachloride for
4 other applications, but --

5 Q. Do you have any understanding as to why
6 zirconium oxide mixed with aluminum oxide would
7 purportedly be more selective for formation of
8 alpha-olefins?

9 A. I don't know. The zirconium would be
10 hydrated on the surface just like the alumina is.

11 Q. Okay. So they both should be acidic; is
12 that right?

13 A. Yes.

14 Q. Is zirconium oxide more acidic or less
15 acidic than alumina?

16 A. It's the hydrated surface, it's acidic, and
17 which was more, I have no idea.

18 Q. Okay. If you look at the next page, page
19 9, there's a scheme 1. Do you see that?

20 A. Yes.

21 Q. And -- and at the bottom, there's -- sorry,
22 scheme 1 at the very top, scheme 1 shows the

1 selectivity of the dehydration of 1-decanol to
2 produce 1 --

3 **A. Yes.**

4 Q. -- decene. And then it shows gamma-alumina
5 along with zirconium on gamma-alumina and theta-
6 alumina with, perhaps no surprise, the zirconium
7 oxide on gamma-alumina being the best across the
8 conversion versus selectivity; is that right?

9 **A. Yes.**

10 Q. There's also a reference to -- the top of
11 the page says the WHSV as being about 6. Do you see
12 that?

13 **A. Yes.**

14 Q. Do you know what WHSV is referring to
15 there?

16 **A. I have to stop and think about that. I**
17 **have no idea.**

18 Q. Okay.

19 **A. I still have no idea.**

20 Q. That's okay. So -- so today, we've looked
21 at I think -- we started with Appleby and Komarewsky,
22 right?

1 **A. Yes.**

2 Q. And then we moved to -- and -- well, sorry,
3 Appleby and Komarewsky, they were strictly activated
4 alumina, temperature range of 350 to 400 C, right?

5 **A. I'd have to go back and look.**

6 Q. Okay.

7 **A. I don't remember.**

8 Q. I'll represent that they were in the range
9 of 350 to 400 --

10 **A. All right.**

11 Q. -- C, but we can agree that it was
12 activated alumina --

13 **A. Yes.**

14 Q. -- in both those, right? And then we have
15 the Wu reference from 1980, which taught that
16 selectivity can be improved by using a base treatment
17 of the catalyst, right?

18 **A. Yes.**

19 Q. And then in 1990, we had Voeste saying that
20 you could improve selectivity by adding ammonia,
21 right?

22 **A. Yes, to the alcohol.**

1 Q. And then here we have the '145 publication,
2 ten years after Voeste, saying use a mixture of
3 zirconium oxide and alumina to provide better --

4 A. Treat --

5 Q. -- selectivity.

6 A. Treat the gamma-aluminum with a zirconium
7 tetrachloride.

8 Q. Yeah, a thin -- a thin layer on --

9 A. Yes.

10 Q. -- top of it, right? Okay. Is it fair to
11 say that the development of new catalysts to convert
12 alcohols to alkenes selectively has been an active
13 area of research going back to the 1940s?

14 A. Yes and no. The result from the 1940s
15 clearly show effective preparation of 1-alkenes by
16 flowing over hot gamma-alumina. The subsequent work
17 -- well, we know further that this has been practiced
18 on a metric ton scale.

19 Q. Right.

20 A. And so it's presumably reasonably reliable.
21 The others have been investigating other aspects.
22 Are they better? That's not clear.

1 Q. Okay. There's -- is it your opinion that
2 there's no way to do an apples-to-apples comparison
3 between the catalysts we've looked at, say, from
4 Appleby and Komarewsky to Wu and Voeste, and now the
5 '145 publication, without actually doing some
6 experiments?

7 **A. It is not clear -- there's nothing in this**
8 **art as described that indicates a superior yield or**
9 **purity of product to the 1944 and 1945 papers.**

10 Q. So if I understand you correctly, 1944 --
11 the Komarewsky and Appleby publications describe very
12 pure alpha-olefins, right?

13 **A. Yes.**

14 Q. And there's nothing you've seen in these
15 subsequent patent applications that we've looked at
16 that would indicate that they were able to obtain the
17 same selectivity and purity; is that right?

18 **A. Superior yield or purity.**

19 Q. Okay. So when you say superior yield,
20 you're referring to the yield, again, of the alpha --
21 desirable alpha product, right?

22 **A. Yes.**

1 Q. Okay. Would a person of ordinary skill in
2 the art viewing these references we've looked at this
3 morning have that same understanding?

4 A. Yes.

5 Q. And that understanding is that Komarewsky
6 and Appleby gave a disclosure of a superior yield and
7 a superior purity?

8 A. One limitation of all of this art is it's
9 very difficult to determine actual chemical yields,
10 and that's true of the '048 patent also.

11 Q. Uh-huh.

12 A. The actual chemical yield is not disclosed.

13 Q. Okay.

14 A. And so compared apples to apples, if they
15 don't say what the actual chemical yield is, it's
16 difficult to compare.

17 Q. Right, and the chemical yield would be you
18 start with, you know, a certain amount of the alcohol
19 and you convert it to a certain amount of an alkene.

20 A. Of the desired 1-alkene, yes.

21 Q. And you would actually want to see how much
22 alkene did you actually make. Is that fair?

1 **A.** **That is -- how much of the -- that's right,**
2 **what the purity of the 1-alkene was and how much you**
3 **got.**

4 MR. LUKAS: Okay. Can we go off the
5 record?

6 (Recessed at 11:22 a.m.)

7 (Reconvened at 11:36 a.m.)

8 BY MR. LUKAS:

9 Q. All right, we're back on the record. So we
10 talked earlier about activation of gamma-alumina by
11 heating. Do you remember that?

12 **A.** **Yes.**

13 Q. When you look at some of the art around
14 catalysts and alumina catalysts, there's also
15 discussion of a process called calcination. Are you
16 familiar with that?

17 **A.** **Not really. My recollection is that**
18 **calcination is just heating, but I could be wrong.**

19 Q. Right, so I guess my question is is when
20 you're talking about activation versus calcination,
21 are they the same or different?

22 **A.** **I really don't know. The -- my sense of**

1 things is that calcination is sort of an archaic
2 term, but it probably means something, heating to a
3 certain degree of dryness and that sort of thing.

4 Q. Okay. Would a person of ordinary skill in
5 the art, do you think that they would understand the
6 difference between calcination and -- and activation?

7 A. A person of ordinary skill in the art
8 working with these catalysts for dehydration would
9 certainly know.

10 Q. Okay. Is -- is a alumina catalyst
11 typically -- well, I think we can agree that an
12 alumina catalyst -- withdrawn. Earlier, we talked
13 about how alumina catalysts are typically activated
14 prior to being used for a catalytic process, right?

15 A. Yes.

16 Q. Would a person of ordinary skill in the art
17 understand that an alumina catalyst is typically
18 calcined prior to being used?

19 A. They would certainly understand that it's
20 activated. The -- as I say, my sense of things is
21 that calcined might be a bit of an archaic term, and
22 so they might operate without ever hearing the word

1 **"calcined" but still be successful.**

2 Q. Okay. Would a person of ordinary skill in
3 the art understand that calcination results in a
4 predictable change to the alumina catalyst?

5 A. Let us define calcine -- calcination as
6 being heated for some time or temperature, and of
7 course, it would depend on the time and temperature.
8 At some temperature, it would probably be possible to
9 destroy the alumina catalyst, so there would be some
10 optimal time and temperature for the activation.

11 Q. Okay, and in order to know what that is for
12 a particular catalyst, would you have to do the
13 experiment?

14 A. Yes.

15 Q. In the references that we discussed earlier
16 today, I think that was Appleby, Komarewsky, Wu --

17 A. Yes.

18 Q. -- Voeste, the '145 publication, do you
19 recall whether there was any description of
20 calcination?

21 A. Do they use that word? I don't recall.

22 Q. Okay.

1 **A. I've certainly seen the word used in regard**
2 **to heating alumina catalysts to activate them.**

3 **Q. Okay, but you don't remember whether those**
4 **particular references described calcination in any**
5 **manner. Is that fair?**

6 **A. Very likely. My recollection is it's**
7 **included in the art that we reviewed for this report.**

8 **Q. Okay.**

9 **A. That word, yes, but I'd have to -- it'd be**
10 **easy to word search it and find it, but --**

11 **Q. Right. If the catalysts that were**
12 **disclosed in those prior art references had not been**
13 **calcined, would a person of ordinary skill in the art**
14 **expect that calcination would have an effect on the**
15 **yield or selectivity?**

16 **A. Let me understand the question. If we**
17 **assume that calcined equals heated to activate, then**
18 **all the catalysts were heated to activate.**

19 **Q. Okay.**

20 **A. The -- and a person of ordinary skill in**
21 **the art would understand that you need to do that.**

22 **Q. Okay.**

1 **A. The -- would a person of ordinary skill in**
2 **the art be tied to the word "calcination"? Perhaps**
3 **not. I don't know.**

4 Q. Okay. I'm going to hand you what is marked
5 as Exhibit 1008, which is U.S. patent application
6 publication number US 2005 slash 0065389 A1. It has
7 a publication date of March 24th, 2005, and I think
8 I'm saying this right, but correct me if I'm wrong.
9 This is the De Bruyn publication; is that right?

10 **A. Yes.**

11 Q. And you relied on this document in forming
12 your opinions?

13 **A. Yes.**

14 Q. This is a published patent application from
15 a company called SASOL Technology; is that right?

16 **A. Yes.**

17 Q. Are you familiar with the company SASOL?

18 **A. Somewhat, yes.**

19 Q. And in what regard?

20 **A. I know that they carry out the dehydration**
21 **of 1-octanol to 1-octene on a metric ton scale.**

22 Q. And how do you know that?

1 **A. I read that as I read the prior art for**
2 **this patent.**

3 Q. Okay. Is it published in a prior art
4 reference somewhere?

5 **A. I may have just Googled them and read about**
6 **them.**

7 Q. Okay. It's on line then.

8 **A. Yeah.**

9 Q. Okay, because I think there's a paragraph
10 in your report that talks about how they -- they do
11 carry out this octanol to 1-octene conversion on a
12 metric ton scale, but there's no citation to any
13 source for that. I was wondering --

14 **A. Okay.**

15 Q. Would a person of ordinary skill in the art
16 be aware of SASOL Technology?

17 **A. Very likely, if they read the patent, they**
18 **would look them up.**

19 Q. Uh-huh, and in your opinion, a person of
20 ordinary skill in the art would be aware of SASOL's
21 commercial conversion of octanol to 1-octene?

22 **A. Yes.**

1 Q. And so looking at the abstract of De Bruyn,
2 which is on the first page of the document. I think
3 you have it in front of you, Doctor. De Bruyn
4 discloses taking an olefin and increasing its chain
5 length by one carbon; is that right?

6 A. Yes.

7 Q. And this is done by hydroformulation,
8 partial reduction to form an alcohol, and then
9 dehydration of the alcohol to form an alkene, right?

10 A. That's right.

11 Q. If we turn to page 3, around paragraphs 36
12 and 37, this is at the bottom of column 1 of page 3.
13 Do you see that? There's a discussion of dehydration
14 reactions in paragraphs 36 and 37, right?

15 A. Yes.

16 Q. And at paragraph 37, De Bruyn discloses
17 that many different dehydration processes are known,
18 but they're not really discussed in -- in any detail,
19 right?

20 A. What they say is that there are -- there's
21 technology available to dehydrate the alcohols to
22 alkenes, and they briefly allude to some ways of

1 **doing that.**

2 Q. Okay, and -- and they say preferably --
3 this is paragraph 37 -- the dehydration is carried
4 out under low acidity condition and low acidity
5 catalyst support, such as alumina, silicon dioxide,
6 titanium dioxide or zirconium dioxide, right?

7 A. And they go on to talk about gamma-alumina
8 catalyst, and that could also be promoted by calcium
9 and so on, anyway.

10 Q. Yeah, so you have a promoted alumina
11 catalyst with --

12 A. Yes.

13 Q. -- calcium oxide?

14 A. Yeah.

15 Q. And it talks about some temperature ranges
16 of 200 to 450 or 250 to 350 degrees C, right?

17 A. And pressures.

18 Q. Yeah, and pressures of zero to 30 bar or
19 typically zero to five bar, right?

20 A. Yes.

21 Q. Okay. And I think we talked a little bit
22 earlier today about promoted alumina catalysts, or

1 maybe not. What is your understanding of what a
2 promoted alumina catalyst is?

3 **A. We talked about treating the alumina**
4 **catalyst in such a way as to minimize the sites that**
5 **cause isomerization of the alkene.**

6 Q. Right.

7 **A. And the -- there's no indication in the**
8 **prior art that this increases the rate of**
9 **dehydration, just that it minimizes the subsequent**
10 **isomerization.**

11 Q. Right. So it doesn't increase the -- it
12 increases the selectivity. Is that fair?

13 **A. It minimizes the isomerization, thereby**
14 **increasing the selectivity.**

15 Q. Okay. So is a promoted alumina catalyst --
16 is it your understanding that that's specifically
17 referring to calcium oxide-treated alumina, or is it
18 -- is it a broader term?

19 **A. It's broader. The -- people talk about**
20 **using barium salts also and --**

21 Q. Okay.

22 **A. -- other -- you know, we talked earlier**

1 **about sodium hydroxide, potassium hydroxide. We**
2 **talked about ammonia.**

3 Q. Okay. Could it be any alkali metal or
4 alkali earth metal?

5 A. Well, it looks that way.

6 Q. Okay.

7 A. But the prior art specifically speaks of
8 calcium and barium for the alkali earths. The
9 zirconium in a way is similar chemistry to the alkali
10 earths and salt. They may be related.

11 Q. Okay. Yeah, I think it was -- one of the
12 references we looked at earlier talked about a layer
13 of zirconium oxide on alumina; is that right?

14 A. Yes.

15 Q. Okay, and it's -- what you're saying here
16 is that that would be similar to a promoted catalyst
17 that's being referred to here in De Bruyn?

18 A. My understanding of a promoted catalyst is
19 a catalyst that minimizes the subsequent
20 isomerization.

21 Q. Okay. I wanted to turn to you to page 8 of
22 De Bruyn, and paragraph 67, top of -- top of page 8,

1 column 1, it says dehydration of 1-hexanol as being
2 step 5. Do you see that?

3 **A. Yes.**

4 Q. And De Bruyn in this example uses a
5 gamma-alumina catalyst that's produced by SASOL
6 Chemie and has a trade name Pural, P-U-R-A-L, KR1; is
7 that right?

8 **A. Yes.**

9 Q. Are -- are you familiar with the
10 gamma-alumina catalyst that's made under this trade
11 name?

12 **A. I don't know the details for the catalyst**
13 **preparation.**

14 Q. Okay. Would a person of ordinary skill in
15 the art know what the details of the preparation of
16 that catalyst entail?

17 **A. They might not. The -- it may well be**
18 **company confidential. All they know is the effect of**
19 **alumina for doing the dehydration.**

20 Q. Okay. So is there any way of knowing
21 whether that's unmodified alumina or modified alumina
22 catalyst?

1 **A. I certainly don't know, and whether**
2 **chemical analysis would show you that, I don't know.**

3 Q. Okay. And there's no way to know if it's
4 been, quote, promoted or treated with a base in any
5 way?

6 **A. No.**

7 Q. Okay.

8 **A. I'm sure SASOL knows.**

9 Q. Yeah, I'm sure they did. They didn't talk
10 about it here though, did they?

11 **A. No.**

12 Q. And it talks about the reaction being
13 conducted at 290 degrees Celsius; is that right?

14 **A. Yes. It's a somewhat lower temperature**
15 **than we've seen before.**

16 Q. That's right, it is, and -- and then in
17 table 10, there's -- they describe this table 10 as
18 being an analysis of product obtained by the
19 dehydration of 1-hexanol at 76.5 conversion in seven
20 hours on stream; is that right?

21 **A. Yes.**

22 Q. I think this goes back to something we

1 talked about earlier. Is there a way to actually
2 tell what the yield was based on this description in
3 table 10?

4 **A. No.**

5 Q. What else -- what other information would
6 you need to know to know what the yield was?

7 **A. The mass. We have a mass percent. They**
8 **have an analysis of the mixture, but there's no net**
9 **mass indicated.**

10 Q. Would a person of ordinary skill in the art
11 want to know what the actual yield was?

12 **A. Yes.**

13 Q. But from this table, there's no way of
14 knowing that, right?

15 **A. That's correct, although in the footnote,**
16 **it talks about how much water was produced, and the**
17 **-- so we have a mass of water that's produced. We**
18 **don't have a mass of product, nor do we have a mass**
19 **of hexanol charged.**

20 Q. Right.

21 **A. So I don't think we have any information**
22 **here to tell the actual chemical yield.**

1 Q. Right, and so -- and the mass of water is
2 -- is 13.7 grams --

3 A. Yes.

4 Q. -- per 100 grams of total product, right?

5 A. **Of product, not starting material, yes.**

6 Q. Yeah, so it's a ratio, right?

7 A. Yes.

8 Q. So if we still -- if we keep with table 10,
9 De Bruyn discloses that there were what I'll refer to
10 as three major products, which are 1-hexene, and I
11 guess 1-hexanol's not a product, but it's --

12 A. **A reactive starting material.**

13 Q. Okay, and then --

14 A. **The difference between 76.5 conversion --**
15 **well, 76 plus 26 is more than a hundred, so it's a**
16 **little peculiar, but anyway --**

17 Q. Right, and then you've got diethyl --
18 dihexyl ether, sorry, at --

19 A. Yes.

20 Q. -- 17, right? And then there's -- there's
21 some smaller amounts of other hexenes, right?

22 A. Yes.

1 Q. So if you were going to calculate the yield
2 -- well, withdrawn. So it states in table 10 that
3 the dehydration gave a 76.5 percent conversion. How
4 is that --

5 A. Gave a 76.5 percent conversion.

6 Q. How is that conversion percentage
7 calculated?

8 A. Usually it would be by looking at the total
9 mass of 1-hexanol charged and at the total mass of
10 1-hexanol recovered and looking at the difference,
11 and you say okay, that's how much -- what percent of
12 hexanol went away.

13 Q. Right, and --

14 A. That was the amount converted.

15 Q. And that's your amount converted.

16 A. Yes.

17 Q. Okay. So is it your understanding based on
18 table 10 and as it's set forth right here in De Bruyn
19 that 76.5 percent of the 1-hexanol was converted to
20 1-hexene?

21 A. Yes.

22 Q. Okay.

1 **A. And the product by weight showed 26.57**
2 **percent still 1-hexanol, anyway.**

3 Q. Yeah, so I'm not sure how that math works.

4 **A. Exactly.**

5 Q. There's also a disclosure here at the top
6 of table 10 about seven hours on stream. What does
7 that refer to?

8 **A. Presumably that's how long their run was.**
9 **Whether they're recycling during that run we don't**
10 **know.**

11 Q. Okay, and what would recycling refer to?

12 **A. Recycling would be putting the reaction**
13 **mixture back into the reactor.**

14 Q. So in other words, you flow hexanol through
15 the reactor, and a portion of it is unreacted, and
16 then you flow that back through again; is that right?

17 **A. Yes. Now, if they were really doing that**
18 **on an operating basis, they would be separating the**
19 **hexenes before they recharged.**

20 Q. Right, by distillation or --

21 **A. Yeah, just -- that would be the volatile**
22 **part, and the non-volatile part would come back in**

1 **the reactor.**

2 Q. Right, and so you can increase the amount
3 of hexanol that's reacted by passing it through
4 multiple times?

5 A. **Yes, and also capture the dihexene, convert**
6 **that to the alkene.**

7 Q. And can that occur on the same catalyst?

8 A. **Yes.**

9 Q. So the formation of the ether from the
10 alcohol is also a reversible reaction?

11 A. **Yes, although it's not likely to reverse to**
12 **2-alcohols. It's more likely to proceed to make the**
13 **alkene and 1-alcohol.**

14 Q. Right, and so a dehydration reaction --

15 A. **And get the --**

16 Q. -- from the ether; is that right?

17 A. **And then dehydration.**

18 Q. Yeah. Would you expect that the time on
19 stream, the amount of time on stream for a catalyst
20 would affect its reactivity?

21 A. **It could. People are very concerned about**
22 **catalyst deactivation, and so the -- depending on**

1 **what the catalyst was, how it was prepared, some**
2 **might last longer than others, remain active longer**
3 **than others.**

4 Q. Okay. How do -- how does a catalyst used
5 for this type of reaction, how does it become
6 deactivated by its use as a catalyst?

7 A. There are active sites on the catalyst, and
8 if they get blocked by whatever is going on in the
9 reaction, then it will no longer be active.

10 Q. Okay. Could -- could a catalyst become
11 more active as it's used for a duration of time?

12 A. I suppose it's possible, but more often,
13 catalysts become deactivated with time.

14 Q. Okay, and a person of ordinary skill in the
15 art would understand that catalysts can become
16 deactivated over time?

17 A. Yes.

18 Q. Is it a goal of researchers in this area to
19 develop catalysts that can remain active for longer
20 periods of time?

21 A. I'm sure it is, although again, we have in
22 the art that I've read very little information about

1 catalysts' lifetimes or turnovers or anything like
2 that. Usually when we speak of catalysts, we talk
3 about catalytic turnover, and I've seen very little
4 in this art that I've reviewed about catalytic
5 turnover.

6 Q. Right, so in terms of the efficiency and
7 the ability to maintain that efficiency; is that
8 right?

9 A. Efficiency and durability, yes.

10 Q. Yeah. Would a person of ordinary skill in
11 the art reviewing this art view that as relevant
12 information to determine whether to use a particular
13 catalyst?

14 A. Yes.

15 Q. Based on the prior art you've looked at,
16 would a person of ordinary skill in the art have to
17 go test the catalyst to determine whether it was able
18 to maintain its efficiency and durability?

19 A. Yes, although the goal of the person of
20 ordinary skill in the art may be to do single runs
21 that give sufficient product without regard to
22 durability. There may be no need, so --

1 Q. Okay. Do you think that would be relevant
2 for an industrial chemical setting?

3 A. It could be. It depends on the scale of
4 the operation.

5 Q. Okay. I do want to look at your
6 declaration briefly about this reference to SASOL's
7 commercial production of 1-octene. I think it's at
8 paragraph 47, Doctor.

9 A. Page 47.

10 Q. Sorry, page 26, paragraph 47.

11 A. Page 26.

12 Q. And it's at the bottom of page 26 there,
13 and you say at paragraph 47, "A person of ordinary
14 skill in the art would know and understand that
15 commercial-scale dehydration reactions are common,
16 have been carried out for decades."

17 A. I'm sorry, we're on page 27, right, not 26?

18 Q. Yeah, page 26, and it goes on to page 27,
19 but --

20 A. Yeah.

21 Q. There's that first -- first sentence, and
22 then you go on to say, "For example, SASOL, a

1 chemical company, has been commercially producing
2 1-octene via dehydration of 1-octanol for many years,
3 certainly before the priority date of the '048
4 patent," and it concludes --

5 **A. Slow down. I know -- I know I said all**
6 **that, but I'm trying to find where it is in the**
7 **report.**

8 Q. Oh, it's page 26 at the bottom of the page.
9 The numbers are on the bottom of the page.

10 **A. Yes, I know.**

11 Q. It's a very -- it's paragraph 47, the
12 bottom of page 26.

13 **A. I have page -- I have paragraph 45 on page**
14 **26.**

15 MR. MURPHY: This one --

16 THE WITNESS: Got the wrong one.

17 MR. MURPHY: You need to use the documents
18 he gave you.

19 THE WITNESS: Oh, the wrong copy. The one
20 with the little -- the little binder clip. Let's try
21 this again.

22 BY MR. LUKAS:

1 Q. Sorry for any confusion.

2 A. All right.

3 Q. We always have to be on the same page.

4 A. Bear with me not being on the same page
5 now. All right, there we go.

6 Q. Okay, so I'll start over. Are you at
7 paragraph 47, Doctor?

8 A. I am.

9 Q. Okay. So you say, "A person of ordinary
10 skill in the art would know and understand that SASOL
11 has been commercially producing 1-octene for many
12 years."

13 A. Yes.

14 Q. And then you conclude on the top of page 27
15 with, "The process at commercial scale is well
16 understood and predictable," and my question is what
17 are you referring to about the process as being well
18 understood and predictable?

19 A. My understanding is the company produces
20 1-octene on a metric ton scale, and does so reliably.

21 Q. Okay, and so a person of ordinary skill in
22 the art would be aware of that, right?

1 **A. Yes.**

2 Q. Would a person of ordinary skill in the art
3 know what catalyst SASOL is using for that conversion
4 on a commercial scale?

5 **A. They would know that they were using**
6 **gamma-alumina, but how the gamma-alumina was**
7 **optimized they would not necessarily know. As we**
8 **saw, they can purchase that, and it works.**

9 Q. Right, and I think they may even make it
10 themselves; is that right?

11 **A. Where does SASOL get their alumina? I**
12 **don't know.**

13 Q. Okay. And do you know, would a person of
14 ordinary skill in the art know what other conditions
15 SASOL is running its conversion at, such as
16 temperature, pressure, flow rate, things of that
17 nature?

18 **A. They may not. They can read the SASOL**
19 **patents as we just did and get some idea.**

20 Q. Right.

21 **A. So --**

22 Q. Okay, but as you sit here today, are you

1 aware of any publication in the public domain that
2 specifically discloses reaction conditions that SASOL
3 uses?

4 **A. Well, let's go back to De Bruyn. I thought**
5 **they had some details here about how they ran the**
6 **dehydration.**

7 Q. Right. So yeah, we go back to De Bruyn at
8 -- and I think the example that they give is again
9 paragraph 67 and 68 on page 8 of De Bruyn.

10 **A. Yes, and they were running to partial**
11 **conversion in this example.**

12 Q. Right, and so this is --

13 **A. And so if you want to do complete**
14 **conversion, presumably you're going to need slower**
15 **flow rate or higher temperature or more catalyst to**
16 **get full conversion to --**

17 Q. Okay.

18 **A. -- 1-hexene.**

19 Q. And would you need to do the experiment to
20 find out if -- if you could get full conversion?

21 **A. Yes.**

22 Q. And in this De Bruyn patent publication,

1 it's disclosing dehydration of 1-hexanol, right?

2 A. Yes.

3 Q. Would you -- would a person of ordinary
4 skill in the art expect that the same yield for
5 1-hexanol that's disclosed here could also be
6 achieved for 1-octanol?

7 A. There's no yield disclosed here, but the --
8 one would assume that things would work about the
9 same for 1-hexanol and 1-octanol. We do know back
10 from 1944 and '45 that complete conversion is easily
11 possible.

12 Q. Uh-huh.

13 A. The specific conditions for complete
14 conversion with a given alumina catalyst would need
15 to be determined experimentally.

16 Q. Okay, and -- and those --

17 A. Completed clean conversion. Again, we
18 don't know yields, but apparently the yields were
19 satisfactory in 1944 and 1945.

20 Q. Right.

21 A. The -- the products are volatile, and so it
22 may not be quite so easy to precisely collect every

1 **bit of 1-hexene, but --**

2 Q. Right. In your mind, would a person of
3 ordinary skill in the art look to De Bruyn, the
4 reference that we're talking here, or would they look
5 to that 1944 and '45 publications that we looked at
6 earlier as being more relevant to the conversion of
7 hexene and heptene and octene?

8 A. A person of ordinary skill in the art would
9 look at it all and look at what was commercially
10 available by way of catalysts and make a decision,
11 but would try first --

12 Q. Okay.

13 A. -- with the expectation that they would be
14 successful reasonably directly.

15 Q. Based on the success in the prior art.

16 A. Yes.

17 Q. Would -- would a person of ordinary skill
18 in the art only look to commercially available
19 catalysts, or would they also try to develop their
20 own catalyst?

21 A. The person of ordinary skill in the art
22 would have a choice. They could use a known catalyst

1 from a commercial vendor such as SASOL if SASOL would
2 sell it to them, or they could go back to commercial
3 untreated gamma-alumina, or there may be some other
4 vendor who's selling gamma-alumina for alcohol
5 dehydration, you know.

6 Q. Uh-huh.

7 A. They would look first. Before they set
8 about doing the experiments themselves, they would
9 look and see what was commercially available.

10 Q. Okay, so first -- first priority is let's
11 -- let's do the thing that's easiest. Is that fair?

12 A. That's right.

13 Q. Okay. I wanted to hand you what's been
14 marked as Exhibit 1007, which is another U.S. patent
15 application publication with number US 2011 slash
16 0196114 A1. It has a publication date of August
17 11th, 2011, and I think you referred to this in your
18 declaration as the Le reference, L-E. Do you
19 recognize this document?

20 A. Yes.

21 Q. And you relied on this document in forming
22 your opinions?

1 **A. Yes.**

2 Q. I looked. I believe this patent
3 application is assigned to a company called Arkema,
4 A-R-K-E-M-A. Are you familiar with Arkema?

5 **A. I've heard of them, but I don't know**
6 **anything about them.**

7 Q. Okay. If we look at the abstract of Le on
8 -- on the cover page, it's not that long, but it
9 says, "The invention relates to a polymer obtained by
10 polymerizing olefins having six to nine carbon atoms
11 and partially derived from renewable resources." Do
12 you see that?

13 **A. Yes.**

14 Q. Then it says a polymer can be derived from
15 vegetable oil or animal fat, right?

16 **A. Yes.**

17 Q. And so part of Le's process that's
18 disclosed in here relates to the dehydration of a C6
19 to C9 alcohol to make a corresponding 1-alkene,
20 right?

21 **A. Yes.**

22 Q. And let's turn to page 4. The numbers are

1 at the top of the pages there, and around paragraph
2 62 on the first column of page 4, there's a step A of
3 the production process. Do you see that?

4 **A. Yes.**

5 Q. And at paragraph 63, Le says that the
6 dehydration step can be carried out in the presence
7 of a dehydration catalyst, for example, a
8 gamma-alumina based catalyst, which may be acidic or
9 basic. Do you see that?

10 **A. Yes.**

11 Q. And then the next paragraph, Le discloses
12 that a basic catalyst, for example, a barium-doped
13 gamma-alumina, is used to increase the selectivity of
14 dehydration, right?

15 **A. Yes.**

16 Q. And in the next sentence, Le goes on to
17 say, "In a second version of the invention, an acidic
18 catalyst can be used to improve the reaction yield."
19 Do you see that?

20 **A. Yes.**

21 Q. And my question for you is would a person
22 of ordinary skill in the art reviewing this have that

1 same understanding of how acidic and basic alumina
2 catalysts can affect reaction yield and selectivity?

3 **A. Well, a person of ordinary skill in the art**
4 **would be familiar with this work and would draw the**
5 **conclusion that it must be true, but again, they**
6 **might particularly be drawn to the last sentence,**
7 **which -- the next to last sentence, which says hey,**
8 **we can buy the catalyst.**

9 Q. Which is -- yeah, so the last sentence of
10 paragraph 64 is what you're looking at, right?

11 **A. Next to last sentence, that's right.**

12 Q. Yeah, so the -- Le is disclosing a catalyst
13 by the company Eurosupport under the trade name ESM
14 110; is that right?

15 **A. Yes.**

16 Q. And it's -- Le discloses that that catalyst
17 is an undoped trilobed alumina containing little
18 residual sodium oxide, usually point 04 percent,
19 right?

20 **A. Yes.**

21 Q. So is it your understanding that that's an
22 unmodified catalyst?

1 **A. No, the -- we don't know what Eurosupport**
2 **does to make this catalyst.**

3 Q. Okay. When -- so -- okay, when -- when Le
4 is saying it's an undoped, trilobed, is -- what is
5 undoped referring to? What's your understanding of
6 that?

7 **A. I don't know. The -- it's whatever the**
8 **company said it was, but it doesn't say anything**
9 **about the method of preparation.**

10 Q. Okay, so would a person of ordinary skill
11 in the art know what that catalyst was?

12 **A. No, they wouldn't know what it was, but**
13 **they would know that this works --**

14 Q. Okay.

15 **A. -- and they would be -- might be motivated**
16 **to purchase it and use it.**

17 Q. Okay, so you don't know what the catalyst
18 is, but you know it's alumina, and you know it works.
19 Is that fair?

20 **A. Yes.**

21 Q. Okay. There's also, if you go into the
22 next paragraph, at the bottom of that, there's a

1 sentence starting, "Preferably." Do you see that?

2 **A. I'm sorry, what paragraph?**

3 **Q. It's the last sentence of paragraph 66.**

4 **A. Oh, 66, okay.**

5 **Q. And it starts with, "Preferably, the**
6 **dehydration catalyst comprises."**

7 **A. Oh, okay. Not the last sentence, but yeah.**

8 **Q. And it says it preferably comprises at**
9 **least one gamma-alumina chosen with a volume of all**
10 **pores included in the gamma-alumina of greater than**
11 **point 9 milliliters per gram; is that right?**

12 **A. And so now they talk about another**
13 **commercial catalyst --**

14 **Q. They do.**

15 **A. -- than SASOL.**

16 **Q. Right, so they're referring in this -- in**
17 **this section to the SASOL catalyst, the Pural KR1,**
18 **right?**

19 **A. And so what we see here is in 2011, we**
20 **become much more sophisticated about understanding**
21 **the internal structure of the gamma-alumina than**
22 **perhaps they were in 1944 and 1945.**

1 Q. Right, and I think De Bruyn was from 2005,
2 right?

3 A. And so the -- now they're being very
4 specific about -- about this, and then say oh, by the
5 way, this stuff's commercial.

6 Q. It is commercially available from --

7 A. Yeah.

8 Q. -- SASOL, right?

9 A. Yes, and it works.

10 Q. And it works. Does it -- does Le disclose
11 what that catalyst is?

12 A. In more detail than what's here, no. They
13 certainly have nothing about method of preparation.

14 Q. Okay, so don't know if it's acid or base
15 treated or modified or unmodified. Is that fair?

16 A. There may be additional literature on this
17 about alumina, gamma-alumina and the structure of
18 gamma-alumina and how it's characterized.

19 Q. Uh-huh.

20 A. But none of that here.

21 Q. Okay. What is your understanding as far as
22 this disclosure in Le as to whether either of these

1 catalysts were used?

2 **A. Used where?**

3 Q. Well, used -- used to do a dehydration
4 reaction.

5 **A. I don't know if they specify later which**
6 **catalyst they use. They mention two commercial**
7 **catalysts here.**

8 Q. Okay.

9 **A. And so --**

10 Q. Yeah, so two -- so Doctor, two commercial
11 catalysts are mentioned at paragraphs 64 and 66,
12 right?

13 **A. Yeah.**

14 Q. And then if we turn to -- it's going to be
15 page 8, column 2, and at paragraph 171, which is the
16 bottom of column 2 --

17 **A. I know they're specific about what -- they**
18 **used a Eurosupport catalyst.**

19 Q. That's right, so in -- in this paragraph
20 171, it's -- it's a Eurosupport temperature of 345,
21 pressure of point 8 bar; is that right?

22 **A. Yes.**

1 Q. And I'll represent to you that I don't see
2 that the SASOL catalyst was used in any other
3 examples of Le. Would a person of ordinary skill in
4 the art understand that the SASOL catalyst that's
5 disclosed earlier, the Pural KR1 catalyst, had
6 actually been used by Le?

7 A. Well, Le says that it works. They must
8 have used it, but they -- they have no details here
9 about that using of it.

10 Q. Okay. Based on this disclosure you've
11 looked at in Le, would a person of ordinary skill in
12 the art select the Eurosupport catalyst or the SASOL
13 KR1 catalyst?

14 A. They'd probably get them both and try them
15 and see which worked better for them.

16 Q. Okay. Is there any way of knowing which
17 one would work better before doing the experiment?

18 A. No, although, you know, if you're so
19 ubiquitous, this reaction, that I think a person of
20 ordinary skill -- well, a person of ordinary skill in
21 the art would be quite confident that they would be
22 able to achieve the dehydration with reasonable yield

1 of purity, acceptable yield of purity.

2 Q. Right, so they would work. Would there be
3 any way of telling how long each one would work or
4 whether one was more durable than the other?

5 A. Well, we don't even know what the person of
6 ordinary skill in the art with the assignment to do
7 the dehydration would care about durability. We
8 don't know what scale they're working on or -- so --
9 but they would know -- no, they would have no way of
10 knowing the durability ahead of time.

11 Q. Okay. Okay, so just sticking with Le, I
12 have a couple more questions for you.

13 A. All right.

14 Q. In -- in this example of Le that's at
15 paragraph 171 --

16 A. Okay.

17 Q. -- to 172 --

18 A. Yes.

19 Q. -- and then 173 as well, is there any
20 disclosure of the yield of 1-heptene?

21 A. There's no indication of how much
22 1-heptanol is charged, and so there's no way to know

1 **what the yield is.**

2 Q. Is there any way to know -- and when we
3 talk about the yield, we're talking about the yield
4 of 1-heptene; is that right?

5 A. **Yes.**

6 Q. And Le doesn't -- maybe I missed it, but I
7 don't see that Le actually discloses what the amount
8 of -- of heptanol that was used in this reaction was;
9 is that right?

10 A. **That's correct.**

11 Q. So we don't know what scale it was, we
12 don't know what the yield was. We just know that it
13 worked. Is that fair?

14 A. **Well, they start with a hundred grams of**
15 **castor oil, so there is an amount there.**

16 Q. Okay.

17 A. **They get the heptanol, and they start with**
18 **ten -- ten kilos of heptanol and hydrogenate it, and**
19 **then they -- presumably they dehydrate the whole**
20 **bunch, but nowhere at the end do they say how much**
21 **heptene they got, so --**

22 Q. Okay. So kilogram scale is what you're

1 read of that is.

2 **A. Kilogram scale.**

3 Q. Okay.

4 **A. Multi-kilo scale.**

5 Q. Right. Just to -- just to be sure, I -- I
6 assume, based on reading your declaration, that you
7 yourself didn't go into a lab and try to reproduce
8 any of these dehydration reactions; is that right?

9 **A. That is correct.**

10 Q. So your -- your assignment, if you will,
11 was to read the prior art and -- and form some
12 opinions. Is that fair?

13 **A. Yes.**

14 Q. Okay. Would you assume that Le, the
15 inventors, authors of -- of the Le reference,
16 actually knew what the yield was?

17 **A. Not necessarily. They know they got a**
18 **substantial supply of 1-hexene -- 1-heptene, and they**
19 **used it to make their further products, and they got**
20 **a sufficient quantity for their products, but whether**
21 **they knew precisely how much 1-heptene they had is**
22 **not clear.**

107

1 Q. Okay. Would a person of ordinary skill in
2 the art reviewing Le want to know what that yield
3 was?

4 A. Well, they'd be curious, but the -- again,
5 these 1-heptene, particularly 1-hexene, certainly
6 even 1-octene are somewhat volatile, and you're going
7 to be making enough of them to have a sufficient
8 supply. Do you care about the precise yield?
9 Probably not.

10 Q. Would --

11 A. You'd have a comfortable, good yield, but
12 you don't care about if it's 97 or 94 or something
13 probably.

14 Q. And would you -- would a person of ordinary
15 skill in the art measure the purity of the 1-heptene
16 that's formed?

17 A. They would care about the purity depending
18 on the application. If -- if they need stuff -- need
19 product that's 98 percent 1-heptene, then they would
20 care a great deal. If they needed a product that's
21 -- that's heptene, we don't care where the double
22 bond is --

1 Q. Uh-huh.

2 A. -- they would care less, so --

3 Q. Right, so -- so the remainder of Le, they
4 talk about a polymerization that then happens.

5 A. Yes.

6 Q. I think it's co-polymerization with
7 ethylene.

8 A. Yes.

9 Q. And I believe the -- the 2-heptene, because
10 it has a methyl group, actually wouldn't
11 co-polymerize with ethylene. Is that fair?

12 A. Many catalysts -- not sure they specify the
13 catalyst here. They probably do. I don't recall.
14 They say fluid bed polymerization, but they don't --

15 Q. Yeah, it just says the catalyst at
16 paragraph 178, right?

17 A. Yeah.

18 Q. I didn't see that the catalyst was named
19 per se, but --

20 A. Yeah, there are catalysts that would be
21 specific for 1-alkenes.

22 Q. Right, and in that case, they wouldn't care

1 what the purity would be, right?

2 **A. Well, they want it to be mainly 1-alkene**
3 **but they don't care what small percentage of other**
4 **stuff there is, yes.**

5 Q. All right. I'm going to hand you what's
6 been marked as Exhibit 1009. This is another
7 published U.S. patent application. It has
8 publication number US 2012 slash 0238788 A1, and the
9 publication date is September 20th, 2012. This is
10 the Wright publication. Wright is W-R-I-G-H-T. You
11 recognize this document --

12 **A. Yes.**

13 Q. -- Doctor? And so this published
14 application came out about a year after Le, right?

15 **A. Yes.**

16 Q. And you relied on this Wright document in
17 forming your opinions?

18 **A. Yes.**

19 Q. If we look at -- again, we'll start with
20 the abstract on the cover page of Wright. It
21 discloses that it provides methods to dehydrate
22 bio-1-alcohols to form bio-alkenes with high

110

1 selectivity.

2 A. Yes.

3 Q. Right? And if we turn to page 2 -- there's
4 some figures up front, but if we turn to page with
5 number 2 at the top --

6 A. Yes.

7 Q. At paragraph 16, there's a -- a disclosure
8 that says, "Embodiments of this invention are to
9 place at least one bio-1-alcohol including water in
10 contact with a solid phase catalyst to produce and
11 isolate at least one bio-1-olefin with high
12 selectivity," and then in parentheses, there's
13 greater than 92 percent, right?

14 A. Yes.

15 Q. So is it your understanding that as the
16 term "high selectivity" is used in this Wright
17 publication, it's referring to greater than 92
18 percent?

19 A. Yes.

20 Q. And then beginning around paragraph 19,
21 which is at the bottom of column 1 on page 2, there's
22 a discussion of some different catalysts that can be

1 used. Do you see that?

2 **A. Yes.**

3 Q. And the catalyst -- one of the catalysts
4 that's disclosed is a combination of zinc oxide and
5 alumina that's been treated at a temperature of 800
6 to a thousand degrees for periods of 24 to 48 hours,
7 right?

8 **A. Yes.**

9 Q. So after it's heated, it's then treated
10 with a base, washed, air dried and then treated with
11 a chlorosilane and a hydrocarbon solvent, right?

12 **A. Yes. Chlorosilane, dichlorosilane,**
13 **trichlorosilane.**

14 Q. Right, and so what is that silane going to
15 do to the surface of a -- of a zinc oxide alumina
16 catalyst?

17 **A. Well, these temperatures are very high, so**
18 **who knows what's happened to the structure of the**
19 **alumina or the zirconium, but that's what it was.**
20 **There's some zirconium in here too.**

21 Q. I think it's just zinc.

22 **A. Zinc.**

112

1 Q. Yeah, zinc.

2 A. I beg your pardon. Anyway, you have zinc
3 and alumina. Who knows what happened after these
4 high temperatures, and so it's a little difficult to
5 say what the silane is doing to the surface, but
6 presumably it's attaching itself covalently to the
7 surface in some way.

8 Q. Okay.

9 A. Probably to oxygens on the surface to form
10 silicon-oxygen bonds.

11 Q. Right, so you have an SiO bond forming on
12 the surface?

13 A. Yes.

14 Q. And would the washing with a base and
15 rinsing with water facilitate that attachment of
16 chlorosilanes to the reaction of chlorosilanes on the
17 surface?

18 A. Well, it's interesting. You would think
19 that they treat -- the additional heating would have
20 dehydrated it, and now we have water back, and I
21 presume when they say treated with base, they mean
22 aqueous base, although they don't say so, but -- so

113

1 **who knows what's going on with this stuff at this**
2 **point. We have no idea of comparing to the previous**
3 **prior art where they talk delicately about the**
4 **structure of the alumina, we have no idea here what**
5 **the structure of the alumina is.**

6 Q. Right, so -- so you're referring to the
7 discussion in I think it was Le that talked about
8 pore size --

9 **A. Yes.**

10 Q. -- and some of the other -- it could be
11 acid or base treated. Here we just have a very high
12 temperature and then we have some base treatment and
13 -- and a chlorosilane, right?

14 **A. Yes.**

15 Q. So is it -- is it your opinion that Le
16 discloses a more specific disclosure of -- of a
17 catalyst that would be useful for dehydration
18 reactions?

19 **A. Well, Le talks about commercial catalysts,**
20 **and in this case, they started with commercial zinc**
21 **oxide and alumina, although they have no details**
22 **about what sort of alumina this is, and then they**

1 **treated it this way. So they're making their own**
2 **catalysts and they're happy with it, but we don't**
3 **really know what the structure of this catalyst is.**

4 Q. Okay. So at paragraph 22, which is still
5 on page 2, there's -- there's a discussion of the
6 catalyst again, the mole ratio, the base, and then
7 there's, about halfway down, the heating ranges from
8 temperatures of about 300 to 420. Do you see that?

9 A. Okay, and so in paragraph 21, they've made
10 their catalyst, included the silane treatment if they
11 do that, which they don't always. Now they're --
12 they have spent catalyst, meaning they've already
13 used it I guess, but then they're going to heat it
14 again at way high temperatures. The --

15 Q. Right, and that's -- that's --

16 A. And then they talk about a heating range of
17 way lower temperatures. It's a little bit confusing.

18 Q. Right, so I think there's a first
19 disclosure there of recycling the spent catalyst by
20 heating at these very high temperatures of 800 to
21 1,100 C, right?

22 A. Yeah, but do they do that after they've

115

1 **done their base treatment and their silane treatment**
2 **also? That's not clear.**

3 Q. Okay. Okay, and then there's also a
4 discussion in that same paragraph 21 of heating
5 ranges for dehydrating of 300 to 420 or 360 to 385.

6 A. **Right.**

7 Q. Do you see that?

8 A. **But when do they do that?**

9 Q. Right.

10 A. **It's not clear. I mean, they have two**
11 **different -- two different heating regimes they**
12 **describe here.**

13 Q. Right, and --

14 A. **It's not clear when in the course of**
15 **catalyst preparation they do these. It is earlier,**
16 **they do it at high temperature, then they treat it**
17 **and they wash it, put silate on it. They do that,**
18 **but then at some point they heat it again. One can**
19 **construe that, but it doesn't say that.**

20 Q. As a person of ordinary skill in the art,
21 in your opinion, would it be easier just to go buy a
22 commercially available alumina catalyst?

116

1 **A.** Yes, so -- but, you know, if the commercial
2 catalysts aren't working for me, then I would be
3 motivated to go back and take it to this and try to
4 figure it out, but I would certainly try the
5 commercial catalyst first.

6 **Q.** Right. So in your opinion, Doctor, does --
7 does this disclosure in this Wright publication
8 provide enough information to reproduce the process
9 that is being practiced or disclosed here?

10 **A.** Probably. It gives you enough indication
11 of what's going on that you should be able to figure
12 out what they actually did and then repeat it, but
13 the -- one does wonder whether they just used a
14 commercial catalyst.

15 **Q.** So if we look at -- I think there's an
16 example in -- in Wright here. If we look at page 3
17 to 4, beginning at the bottom of column 2 of page 3
18 at paragraph 34, there's an example 1. Do you see
19 that?

20 **A.** Yes.

21 **Q.** And the example relates to 1-butanol that
22 contained 18 percent water by weight, right?

1 **A. Yes.**

2 Q. And then there's a disclosure of
3 gamma-alumina powder that had a specific pore volume
4 that was from the Strem Chemical.

5 **A. Right.**

6 Q. And it was modified with a base, dried and
7 then modified with a two percent --

8 **A. Yes.**

9 Q. -- by weight diphenylsilane, right?

10 **A. Yes.**

11 Q. I'm sorry, that's diphenylsilane and
12 dichlorosilane and hexanes.

13 **A. It's diphenyldichlorosilane is what that**
14 **probably should be, but we don't really know.**
15 **Something that has four bonds.**

16 Q. I guess that's a question, is that -- is
17 that a mixture of diphenylsilane and dichlorosilane
18 or is it diphenyldichlorosilane?

19 **A. A person of ordinary skill in the art would**
20 **probably presume the latter, but it's just inaccurate**
21 **patent writing, but --**

22 Q. Yeah.

1 A. So we have -- we start with 300 grams of
2 alumina to do the base wash, and we treat it with the
3 chlorosilane, and now we're down to 280 grams --

4 Q. Uh-huh.

5 A. -- which is air dried and heated, and
6 presumably that's the temperature. The 380 degrees
7 is the temperature of the dehydration. I'm sorry,
8 it's the temperature of the conversion of the
9 alcohol, of the 1-butanol to the 1-butane.

10 Q. Right, right, and that's the temperature
11 the catalyst was heated to, right?

12 A. Yeah, but whether they heated that for a
13 time to get it dehydrated and out of the butanol
14 probably, but they don't quite say so.

15 Q. All right. And then there's -- after this
16 example and this discussion, there's a table 1. Do
17 you see that?

18 A. Yes.

19 Q. It looks like there were three runs that
20 were performed; is that right?

21 A. Yes, and it looks like the last one ran for
22 123 days.

119

1 Q. Which is pretty long, right?

2 A. Yeah, the catalyst must have been
3 reasonably robust.

4 Q. Right. And there's actually a chemical
5 yield of biobutenes that's disclosed here that's
6 between 96 and 98 percent, right?

7 A. Yes, so they say, uh-huh.

8 Q. So they say. What -- what additional
9 information would you like to see in this table as a
10 person of ordinary skill in the art?

11 A. Biobutene of course is a gas at room
12 temperature, and so one would presume they condensed
13 it and had the liquid form and weighed it, but --

14 Q. Would you want to see the data from those
15 -- the numbers of the amount of -- of biobutanol and
16 then the resulting amount of biobutene that was
17 formed?

18 A. If they claim a chemical yield, it's
19 probably true.

20 Q. Okay.

21 A. And it's certainly in line -- it's actually
22 heartening as a person to try to develop a process,

1 it would be very heartening to say oh, here's a real
2 chemical yield. We have assumed these other things
3 worked okay.

4 Q. Right.

5 A. But now we actually are being told in black
6 and white that they do work okay.

7 Q. We have a yield. This is the first
8 disclosure --

9 A. Yes.

10 Q. -- of a yield in -- in --

11 A. Yes.

12 Q. -- terms of --

13 A. Yes.

14 Q. -- the recent prior art we've looked at,
15 right? Would a person of ordinary skill in the art
16 expect that this same reaction that's described here
17 in example 1 for bio-1-butane could also be used for
18 bio-1-pentene or bio-1-hexene or bio-1-heptene?

19 A. A bio-1-octene, sure, just in general,
20 dehydrating 1-alcohol to 1-alkenes, and the reach of
21 selectivity seems to be consistent also even with
22 very long runs.

1 Q. Right. It's -- it's a robust catalyst,
2 right?

3 A. Yeah.

4 Q. Is there -- is there a carbon chain length
5 that a person of ordinary skill in the art would
6 expect this reaction would no longer work for?

7 A. Not in the normal operating range. I
8 suppose you can get something with a hundred carbon
9 atoms that it would not be volatile enough to go --

10 Q. Right.

11 A. -- through the column.

12 Q. Are you limited by the volatility of the
13 hydrocarbon to some degree?

14 A. Yes, but that wouldn't be a limit up to
15 C20, but it might be a limit to a C100 or something.

16 Q. Okay. So you'd expect that the same
17 reaction should work -- if it works for C4, it should
18 work all the way up to C20?

19 A. Yeah.

20 Q. Okay. I have -- I think this might be the
21 last reference for you, Doctor. Pardon me. This is
22 an exhibit marked 1010. It's a U.S. patent, patent

1 number US 6,528,665 B1. First named inventor is a
2 Chi Hung Cheng. I think you called this the Cheng
3 reference. That's spelled C-H-E-N-G, and this is a
4 patent that issued in 2003, right?

5 **A. Yes.**

6 Q. And you relied on Cheng in forming your
7 opinions?

8 **A. Yes.**

9 Q. If -- and in terms of the disclosure that
10 you rely on in -- in Cheng, Doctor, Cheng discloses
11 the conversion of epoxyalkenes to make diols, right?

12 **A. Yes.**

13 Q. Sorry, epoxyalkanes to make diols, right?
14 And so is it fair to say you're relying on Cheng for
15 its disclosure that you can use epoxyalkane as well
16 as alkenes to then convert them into 1,2-alkanediols?

17 **A. Yes. Well, also that, but also that the --**
18 **there are applications for the 1-octene besides --**
19 **there are applications for the 1-octene.**

20 Q. And what are those?

21 **A. Well, they could be epoxide, for instance.**
22 **In this case it's a hexane they're making. One could**

123

1 **imagine making the -- in a similar way making the**
2 **epoxide from the octene.**

3 Q. Okay, and so your -- your citation and
4 discussion of Cheng, it's fair to say, relates to
5 taking the -- the alkenes and then making subsequent
6 products with those; is that right?

7 A. **Yes.**

8 Q. You're not citing Cheng for any -- any
9 catalysts that are being used to make the alkenes,
10 right?

11 A. **My recollection is that Cheng did not talk**
12 **about dehydrations. I could be wrong I suppose.**

13 MR. LUKAS: All right. Thank you for your
14 time. I have no questions on cross examination for
15 you. To the extent your counsel asks you any
16 redirect, I may recross you, but I thank you for your
17 time today.

18 THE WITNESS: Sure.

19 MR. MURPHY: Can we take a short break and
20 I'll get organized and --

21 MR. LUKAS: Yeah.

22 (Recessed at 12:38 p.m.)

1 (Reconvened at 1:06 p.m.)

2 EXAMINATION BY COUNSEL FOR SYMRISE AG

3 BY MR. MURPHY:

4 Q. Dr. Taber, do you recall earlier in your
5 testimony when we were discussing potentially
6 performing some experiments?

7 A. I'm sorry, do I recall --

8 Q. Earlier in your testimony, when you
9 discussed performing experimentation?

10 A. Yes.

11 Q. And would a person of skill in the art need
12 to perform any experiments to reach the conclusions
13 in your declaration?

14 A. No, no, the prior art would give them a
15 strong expectation of success.

16 MR. MURPHY: That's all I have.

17 MR. LUKAS: I don't have any more questions
18 for you, Doctor. Thank you.

19 (Whereupon, at 1:07 p.m., the taking of the
20 instant deposition ceased.)

21

22

125

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

CERTIFICATE OF DEPONENT

I have read and examined the foregoing
pages and find the answers contained therein with
changes made by me, if any, to be true and correct.

Signature of the Witness

Subscribed and sworn to before me this
_____ day of _____, 20____.

Notary Public in and for

My Commission Expires _____.

1 CERTIFICATE OF REPORTER

2 I, Karen Young, Court Reporter and Notary
3 Public in and for the District of Columbia, the
4 officer before whom the deposition was taken, do
5 hereby certify that the foregoing transcript is a
6 true and accurate record of the deposition of
Douglass F. Taber, Ph.D., that the witness was duly
sworn, that said deposition was taken in Stenotype
notes by me on the 23rd day of January 2024,
commencing at 10:03 a.m., and ending at 1:07 p.m.

7 I further certify that present on behalf of
8 Petitioners Symrise AG was Ryan M. Murphy of
9 Polsinelli, and present on behalf of Patent Owner
Inolex Inc. was Aaron Lukas of Cozen O'Connor.

10 I further certify that I am not related to,
11 nor associated with any of the parties or their
attorneys, nor do I have any disqualifying interest,
personal or financial, in the actions within.

12 Dated this 29th day of January 2024 in
13 Washington, D.C.

14 

Karen Young

15 My Commission Expires:

16 July 31, 2024
17
18
19
20
21
22

A	actions 126:11	affect 85:20	85:6,13	42:4,7,8 43:9
A-R-K-E-M-A	activate 29:1,9	98:2	alkenes 54:4	43:12,17
96:4	29:12 30:11	AG 1:5 2:2	66:12 75:22	44:5,7,20,21
a.m 1:20 69:6	44:20 45:7	5:15 10:19	122:16 123:5	45:3,5 47:9
69:7 126:6	72:2,17,18	124:2 126:7	123:9	48:12,21
A1 4:6,8,10,13	activated	agency 9:6	alkenol 50:19	49:6,18,21
4:18 45:16	27:22 28:19	agent 39:11	alkenols 40:12	50:17 63:2
55:11 73:6	28:21,22	ago 6:16 7:16	40:13	63:10,15
95:16 109:8	29:16 30:9	9:1	allude 75:22	64:6 65:4,12
Aaron 2:11	31:12 33:15	agree 65:11	alpha 52:21,22	66:3 69:14
5:17 126:8	33:16 34:6	70:11	67:20,21	70:10,12,13
ability 42:3	35:8 36:15	Ah-ha 11:11	alpha- 58:18	70:17 71:4,9
87:7	40:8 43:8,19	ahead 18:17	59:11	72:2 76:5,10
able 67:16	44:5,8,9,11	21:8 104:10	alpha-olefin	76:22 77:2,3
87:17 103:22	44:13,14	air 8:9 111:10	48:21 49:13	77:15,17
116:11	45:1 65:3,12	118:5	53:7 54:17	78:13 79:19
above-entitled	70:13,20	al 4:14,15	59:13	79:21,21
1:18	activation	Al2O3 28:8	alpha-olefins	91:11 93:14
abstract 56:8	44:17 69:10	alcohol 37:7	48:14 62:6	98:1,17
56:11,18,22	69:20 70:6	50:8 56:14	62:13 63:8	99:18 101:17
75:1 96:7	71:10	57:4,7 58:2	67:12	111:5,15,19
109:20	active 29:3,14	65:22 68:18	alpha-select...	112:3 113:4
acceptable	30:2 49:6	75:8,9 85:10	62:15	113:5,21,22
104:1	62:15 66:12	95:4 96:19	altering 39:11	115:22 118:2
accomplished	86:2,7,9,11	118:9	alukas@coz...	Alumina's
50:7	86:19	alcohols 24:9	2:15	28:6
accurate 126:4	activity 39:7	27:22 35:15	alumina 21:9	aluminate 33:8
achieve 52:17	39:12 61:14	38:4 47:8,16	21:10 26:16	aluminum
103:22	activity- 39:10	57:20 58:21	27:6 28:1,5	28:6,7 32:19
achieved 93:6	actual 31:19	59:12 61:14	28:12,19,21	33:7,11,13
acid 20:14,14	68:9,12,15	62:14 66:12	28:22 29:1,3	33:18,19,20
26:11,12,13	81:11,22	75:21	29:10,12,14	34:12 36:15
26:13,17	add 21:7 25:21	aliphatic 56:14	29:16,17	58:5,15
39:22 40:6	50:18 53:9	57:3 62:3,5	30:2,2,8,9,12	60:20 62:16
101:14	adding 65:20	alkali 48:15,19	31:13 33:6	63:6
113:11	addition 50:8	49:16,19	33:12,14,15	ammonia
acidic 20:14	52:20,22	78:3,4,8,9	33:16,20,22	50:10,18
39:13 40:10	additional	alkaline 48:15	34:1,6,13,17	52:11,20,22
40:22 41:1	10:16 101:16	48:20 49:17	34:18 35:1,3	53:7,9 65:20
63:11,14,15	112:19 119:8	49:19	35:6,8 36:15	78:2
63:16 97:8	address 6:7	alkene 24:8	39:3,14 40:8	ammonium
97:17 98:1	addressing	68:19,22	41:1,2,9,14	33:8
acidity 76:4,4	17:18	75:9 77:5	41:17,19,20	amount 52:21

53:1,11 68:18,19 83:14,15 85:2,19 105:7,15 119:15,16 amounts 82:21 analysis 80:2 80:18 81:8 anhydride 20:15,15 animal 96:15 answer 7:1,11 15:11 18:12 18:16,17 60:12 answers 125:3 anyway 18:12 31:1 76:9 82:16 84:2 112:2 apparently 93:18 APPEAL 1:3 APPEARAN... 2:1 Appleby 4:14 27:12,18,20 32:11 34:14 34:18 35:3 36:12 37:22 38:16 43:8 43:14 51:3 64:21 65:3 67:4,11 68:6 71:16 apples 68:14 68:14 apples-to-ap... 67:2 application 4:5,7,9,13	45:15 48:11 50:4 55:10 73:5,14 95:15 96:3 107:18 109:7 109:14 applications 19:20 29:20 63:4 67:15 122:18,19 approached 42:7 appropriate 45:1 appropriately 34:16 40:19 April 32:4 aptly 19:2 aqueous 41:2 41:3 112:22 archaic 70:1 70:21 area 66:13 86:18 areas 49:6 Arkema 96:3,4 art 9:12,14,18 16:7,8 19:2 22:5,10 30:1 30:3,7 31:7,9 31:19 34:9 36:9 37:17 45:9 47:12 53:17 54:15 59:11 60:6 60:10,13,14 60:14,22 67:8 68:2,8 69:13 70:5,7 70:16 71:3 72:7,12,13 72:21 73:2 74:1,3,15,20	77:8 78:7 79:15 81:10 86:15,22 87:4,11,11 87:15,16,20 88:14 90:10 90:22 91:2 91:14 93:4 94:3,8,15,18 94:21 97:22 98:3 99:11 103:4,12,21 104:6 106:11 107:2,15 113:3 115:20 117:19 119:10 120:14,15 121:5 124:11 124:14 article 4:14,15 27:12 32:1 48:1 articles 36:14 aside 38:1 45:13 asking 9:7 19:7 asks 123:15 aspects 66:21 assigned 96:3 assignment 104:6 106:10 associated 126:10 assume 30:21 72:17 93:8 106:6,14 assumed 120:2 Assuming 36:3 assumption	31:4 atmospheric 43:4 50:11 58:1 atoms 96:10 121:9 attaching 112:6 attachment 112:15 attempting 30:7 attorneys 9:14 10:3 126:10 August 27:13 95:16 author 32:2 38:4 authored 23:18 authors 106:15 availability 28:17 available 39:3 39:8,13 75:21 94:10 94:18 95:9 101:6 115:22 aviation 8:9 aware 20:3 30:4 60:14 74:16,20 90:22 92:1 B B 4:1 B1 4:11 122:1 B2 4:3 back 13:11 15:9,22 16:3 31:19 35:10 49:1 53:12	65:5 66:13 69:9 80:22 84:13,16,22 92:4,7 93:9 95:2 112:20 116:3 background 8:13,14,17 8:20 9:21 31:14 bar 76:18,19 102:21 barium 49:5 77:20 78:8 barium-doped 97:12 base 41:7 43:12,18 50:18 65:16 80:4 101:14 111:10 112:14,21,22 113:11,12 114:6 115:1 117:6 118:2 based 8:19 81:2 83:17 87:15 94:15 97:8 103:10 106:6 basic 49:17 97:9,12 98:1 basically 40:7 40:11 basis 84:18 batch 44:21 45:2,5 Bear 90:4 bed 18:6,7,21 108:14 beg 112:2 beginning 46:16 47:4
---	--	---	--	---

47:15 59:9	119:5	byproduct	121:8	60:20 61:1
61:20 62:1	bit 51:2 70:21	40:14	care 104:7	62:15,21
62:11 110:20	76:21 94:1	byproducts	107:8,12,17	65:17 70:10
116:17	114:17	53:8,11	107:20,21	70:12,17
behalf 2:2,10	black 120:5		108:2,22	71:4,9,12
5:18,20	blocked 86:8	C	109:3	76:5,8,11
126:7,8	BOARD 1:3	C 3:1 5:1 30:19	career 19:19	77:2,4,15
believe 30:16	bond 107:22	42:14,16	carried 19:18	78:16,18,19
45:16,18	112:11	48:13 50:12	57:22 76:3	79:5,10,12
46:17,21	bonding 27:6	50:22 58:2	88:16 97:6	79:16,22
53:13 61:5	bonds 49:20	65:4,11	carrier 37:10	85:7,19,22
96:2 108:9	112:10	76:16 114:21	37:11,12,13	86:1,4,6,7,10
bench- 21:11	117:15	C-H-E-N-G	carry 73:20	87:13,17
best 64:7	book 23:19,20	122:3	74:11	91:3 92:15
better 66:3,22	bottom 24:8	C.V 11:10	case 7:21 8:8	93:14 94:20
103:15,17	24:12 56:10	C100 121:15	9:7,8 10:7	94:22 97:7,8
binder 89:20	56:20 63:21	C20 121:15,18	13:22 19:14	97:12,18
bio-1-alcohol	75:12 88:12	C4 121:17	48:11 108:22	98:8,12,16
110:9	89:8,9,12	C6 96:18	113:20	98:22 99:2
bio-1-alcohols	99:22 102:16	C9 96:19	122:22	99:11,17
109:22	110:21	calcination	cases 8:1,2,4	100:6,13,17
bio-1-butane	116:17	69:15,18,20	8:6,7	101:11 102:6
120:17	break 7:8	70:1,6 71:3,5	castor 105:15	102:18 103:2
bio-1-heptene	123:19	71:20 72:4	catalyst 15:11	103:4,5,12
120:18	breaks 7:7	72:14 73:2	20:6 26:13	103:13
bio-1-hexene	briefly 75:22	calcine 71:5	26:16,17	108:13,15,18
120:18	88:6	calcined 70:18	27:6 32:20	110:10 111:3
bio-1-octene	broader 31:15	70:21 71:1	33:2,5,6,13	111:16
120:19	31:16,21	72:13,17	34:12,14,17	113:17 114:3
bio-1-olefin	77:18,19	calcium 49:4	34:18 35:1,3	114:6,10,12
110:11	Bruyn 73:9	76:8,13	35:16 36:16	114:19
bio-1-pentene	75:1,3,16	77:17 78:8	39:2,11	115:15,22
120:18	78:17,22	calculate 83:1	40:20 43:18	116:5,14
bio-2- 12:6	79:4 82:9	calculated	43:19 44:5,7	118:11 119:2
bio-2-octanol	83:18 92:4,7	83:7	44:8 45:1	121:1
12:4,15	92:9,22 94:3	called 1:17 5:6	47:9 48:12	catalysts
bio-alkenes	101:1	69:15 73:15	48:15,21	17:19 19:17
109:22	bulk 28:12	96:3 122:2	49:7,11	19:18,20,21
biobutanol	bunch 105:20	capture 85:5	50:13 51:6,8	21:2 22:15
119:15	butanol	carbocation	51:16,20	58:10,11,17
biobutene	118:13	25:7	53:6 55:3	59:12 61:13
119:11,16	buy 98:8	carbon 75:5	58:5 59:16	66:11 67:3
biobutenes	115:21	96:10 121:4	59:21 60:1	69:14,14

70:8,13 72:2 72:11,18 76:22 86:13 86:15,19 87:2 94:10 94:19 98:2 102:1,7,11 108:12,20 110:22 111:3 113:19 114:2 116:2 123:9 catalysts' 87:1 catalytic 23:6 63:2 70:14 87:3,4 catalyzed 26:11 39:22 cause 77:5 ceased 124:20 Celsius 30:22 31:3,8 35:20 80:13 centimeters 36:18 certain 44:22 68:18,19 70:3 certainly 10:22 29:19 70:9 70:19 72:1 80:1 89:3 101:13 107:5 116:4 119:21 CERTIFICATE 125:1 126:1 certify 126:3,7 126:9 chain 75:4 121:4 challenged 14:22 17:9 change 71:4 changes 125:4	characterized 101:18 charged 81:19 83:9 104:22 check 15:3 chemical 17:2 17:7 21:17 22:11 68:9 68:12,15,17 80:2 81:22 88:2 89:1 117:4 119:4 119:18 120:2 Chemie 79:6 chemist 37:6 44:15 chemistry 21:4 21:21 22:7 22:12 23:12 23:17 24:1,3 24:3 78:9 Cheng 122:2,2 122:6,10,10 122:14 123:4 123:8,11 Chi 122:2 chloride 33:8 chlorosilane 111:11,12 113:13 118:3 chlorosilanes 112:16,16 choice 94:22 chosen 100:9 citation 23:10 24:4 74:12 123:3 cited 10:12 citing 123:8 claim 15:16 17:22 18:5,6 18:10 19:6 119:18	claimed 17:2,7 claims 14:17 14:21,22 15:2,7,10,17 15:17,20 17:8,9,16 clarification 18:19 classes 23:20 clean 34:22 93:17 clear 17:6 18:15 19:13 33:7 43:3 66:22 67:7 106:22 115:2 115:10,14 clearly 54:20 66:15 clip 89:20 co-polymeri... 108:6 co-polymerize 108:11 colleagues 21:21 collect 93:22 color 8:10 Columbia 126:2 column 30:13 32:10,18 33:1 35:11 39:1 40:22 42:9,10 44:2 75:12 79:1 97:2 102:15 102:16 110:21 116:17 121:11 combination 111:4	combinations 16:8 combined 62:20 come 20:12 29:20 37:8 84:22 comes 49:2 comfortable 107:11 commencing 126:6 comment 25:2 comments 60:16 commercial 40:16,17,17 61:12 74:21 88:7 90:15 91:4 95:1,2 100:13 101:5 102:6,10 113:19,20 116:1,5,14 commercial-... 88:15 commercially 39:4 89:1 90:11 94:9 94:18 95:9 101:6 115:22 Commission 125:17 126:15 common 88:15 company 21:18,20 22:11 73:15 73:17 79:18 89:1 90:19 96:3 98:13 99:8	compare 36:20 68:16 compared 36:2 68:14 comparing 113:2 comparison 67:2 complete 6:22 92:13 93:10 93:13 Completed 93:17 completion 24:14 complex 26:22 27:3 complexes 23:1,1,2 component 56:14 composition 40:18 comprises 100:6,8 comprising 56:12 62:15 concepts 25:19 26:22 conceptually 26:8 27:8 concern 11:19 concerned 85:21 conclude 90:14 concludes 89:4 conclusion 98:5 conclusions 124:12 condensed
--	---	---	---	--

119:12 condition 76:4 conditions 91:14 92:2 93:13 conduct 9:11 conducted 80:13 confident 103:21 confidential 79:18 confusing 114:17 confusion 90:1 consider 27:17 38:8 55:15 considered 43:19 44:8 46:5 consistent 120:21 consists 50:13 constant 35:16 construe 115:19 consult 21:19 consultant 22:3 consulted 22:2 consumption 54:1 contact 110:10 contacted 8:21 9:5,11 contain 11:17 contained 116:22 125:3 containing	98:17 contains 19:13 contemplated 43:2 continue 39:6 controlled 37:5 conversations 10:6 conversion 50:7 52:18 53:6 64:8 74:11,21 80:19 82:14 83:3,5,6 91:3 91:15 92:11 92:14,16,20 93:10,14,17 94:6 118:8 122:11 convert 58:18 66:11 68:19 85:5 122:16 converted 83:14,15,19 converts 40:2 copper 23:1 copy 23:15 89:19 corner 38:12 Corp 5:18 Corporation 5:16 correct 15:20 15:21 19:14 26:3 35:21 53:7 61:2,5 73:8 81:15 105:10 106:9 125:4 corrections 12:17 correctly	67:10 correspondi... 57:4,7 62:6 96:19 counsel 1:17 4:21 5:7,21 7:8 8:15 123:15 124:2 couple 47:11 104:12 course 10:6 71:7 115:14 119:11 court 6:20 126:2 covalently 112:6 cover 56:18 96:8 109:20 COVID 6:16 Cozen 2:12 5:17 126:8 create 44:4 62:20 creating 29:2 cross 123:14 curious 107:4 current 59:15 currently 6:4 42:15 D D 5:1 D.C 1:14,20 2:6,14 5:18 126:12 data 119:14 date 11:12,14 17:1 32:3 38:12 45:16 45:17,18,19 53:16 55:12 73:7 89:3	95:16 109:9 dated 27:12 126:12 day 125:10 126:5,12 days 118:22 De 4:13 45:16 73:9 75:1,3 75:16 78:17 78:22 79:4 82:9 83:18 92:4,7,9,22 94:3 101:1 deactivate 49:8 deactivated 86:6,13,16 deactivation 85:22 deal 9:15 107:20 decades 17:4 88:16 December 45:17 47:13 decene 64:4 decision 94:10 declaration 4:4 8:18,19 10:12 11:3 11:16 12:18 12:21 13:12 13:18,20 15:22 16:4 16:13,21 19:10,12 23:3 24:5 53:13 88:6 95:18 106:6 124:13 declare 46:18 decrease 54:19	define 71:5 degree 36:3,10 36:11 70:3 121:13 degrees 30:18 30:19,22 31:3,7 33:18 34:5 35:16 36:2 42:14 48:13 50:22 58:2 76:16 80:13 111:6 118:6 dehydrate 12:5,15 30:7 75:21 105:19 109:21 dehydrated 32:19 47:17 58:21 112:20 118:13 dehydrating 57:19 62:5 62:14 115:5 120:20 dehydration 9:13 12:12 17:11,13,20 18:22 20:7 21:2 23:5 24:9,11,13 25:1 27:9,22 37:18 38:4 43:13 47:8 50:9,10 54:16 57:6 61:14 64:1 70:8 73:20 75:9,13,17 76:3 77:9 79:1,19 80:19 83:3 85:14,17
---	---	--	--	--

88:15 89:2	design 53:19	40:16 44:12	42:21 50:21	122:10
92:6 93:1	designated	58:17 60:12	93:1 98:12	124:18
95:5 96:18	5:14	69:21 75:17	disclosure	document
97:6,7,14	desirable 39:9	110:22	68:6 84:5	10:20 13:17
100:6 102:3	43:2 67:21	115:11,11	101:22	27:15,17
103:22 104:7	desire 44:15	difficult 27:4	103:10	32:4,6 38:6
106:8 113:17	desired 39:11	36:20 68:9	104:20 110:7	38:21 45:13
118:7	39:15,19	68:16 112:4	113:16	45:14 46:3
dehydrations	54:5,7,9,17	dihexene 85:5	114:19 116:7	46:16,17
123:12	55:2 68:20	dihexyl 82:18	117:2 120:8	55:13 56:18
delicately	destroy 71:9	dimensions	122:9,15	62:10 73:11
113:3	detail 31:18	36:16	discussed	75:2 95:19
depend 71:7	75:18 101:12	diols 122:11	8:14 71:15	95:21 109:11
depending	details 15:11	122:13	75:18 124:9	109:16
85:22 107:17	79:12,15	dioxide 76:5,6	discusses	documentati...
depends 54:20	92:5 103:8	76:6	24:15	49:2
88:3	113:21	diphenyldic...	discussing	documents
DEPONENT	determine	117:13,18	25:1 26:11	10:9 14:2
125:1	16:7 29:13	diphenylsila...	124:5	89:17
deposed 6:10	68:9 87:12	117:9,11,17	discussion	doing 21:21
7:13 8:3	87:17	directions	24:18 33:2	22:12 41:8
deposition	determined	12:5,16	42:19 69:15	44:19 48:5
1:16 5:2 6:15	93:15	directly 94:14	75:13 110:22	67:5 76:1
7:19 8:12	develop 22:14	dirhodium	113:7 114:5	79:19 84:17
10:8 124:20	86:19 94:19	22:22	115:4 118:16	95:8 103:17
126:3,4,5	119:22	discern 27:5	123:4	112:5
deprotonation	developed	disclose	disqualifying	domain 92:1
25:7	19:20	101:10	126:10	doped 48:15
derived 96:11	development	disclosed	dissuade	doping 48:19
96:14	66:11	47:18 68:12	60:21	double 55:19
describe 67:11	diameter	72:12 93:5,7	distillation	55:20 107:21
80:17 115:12	36:18,19,19	96:18 103:5	24:16 84:20	Douglass 1:16
described	37:3	111:4 116:9	District 126:2	3:3 4:4 5:4
22:13 34:12	dichlorosilane	119:5	Doctor 6:1	6:3 126:4
34:17 35:2	111:12	discloses	10:21 27:15	Dr 6:9 19:17
36:10,11	117:12,17	42:21 51:8	35:1 38:6	46:15 124:4
37:19 43:18	diethyl 82:17	75:4,16 82:9	45:13 51:8	draw 98:4
67:8 72:4	difference	92:2 97:11	53:15 57:10	drawbacks
120:16	35:22 36:9	98:16 105:7	61:18 75:3	61:12
description	70:6 82:14	109:21	88:8 90:7	drawn 98:6
42:10 48:9	83:10	113:16	102:10	dried 33:21
60:8,19	different 20:22	122:10	109:13 116:6	44:7,7
71:19 81:2	24:1,19 39:9	disclosing	121:21	111:10 117:6

118:5 dry 29:2 33:18 43:21,21 drying 28:22 29:1,4 33:16 34:5 41:5 44:4 dryness 70:3 duly 5:8 126:4 durability 87:9 87:18,22 104:7,10 durable 104:4 duration 86:11 dwel 51:6	either 25:10 101:22 elements 20:3 Embodiments 110:8 empirical 29:12 48:22 employ 42:15 employed 6:4 energy 54:1 English 46:20 47:1 ensure 45:6 entail 79:16 entire 56:9 epoxide 122:21 123:2 epoxyalkane 122:15 epoxyalkanes 122:13 epoxyalkenes 122:11 equals 72:17 equivalent 34:13 35:3 ESM 98:13 ESQ 2:3,11 et 4:14,15 ether 82:18 85:9,16 ethylene 108:7 108:11 Eurosupport 98:13 99:1 102:18,20 103:12 everybody 10:18 13:10 51:9,10 evidence 61:2 61:4 Exactly 84:4	examination 1:17 5:7,21 123:14 124:2 examined 5:9 125:2 example 12:10 26:12 39:13 53:22 58:14 58:15 79:4 88:22 92:8 92:11 97:7 97:12 104:14 116:16,18,21 118:16 120:17 examples 22:19 103:3 excerpt 4:16 23:17 excess 39:13 excessive 39:14,19 excuse 21:3 exhibit 4:2 10:16,17,20 15:14 23:16 27:11 30:14 32:1,15 38:2 38:7,8 45:14 46:5 47:3 53:13 55:9 55:15 73:5 95:14 109:6 121:22 exhibits 4:21 5:2 10:15 expect 12:12 35:22 36:9 42:6 72:14 85:18 93:4 120:16 121:6 121:16 expectation	35:4 94:13 124:15 expected 12:7 experience 19:16 21:4 22:6,10 48:22 experiment 31:10 44:19 45:4 55:4 71:13 92:19 103:17 experimental 35:12 experimenta... 93:15 experimenta... 54:21 124:9 experiments 67:6 95:8 124:6,12 expert 46:18 Expires 125:17 126:15 extends 13:18 extent 123:15 Eye 1:19 2:5	99:19 101:15 105:13 106:12 108:11 122:14 123:4 familiar 28:18 69:16 73:17 79:9 96:4 98:4 far 101:21 fast 26:7 fat 96:15 fatty 47:8 50:8 Feel 11:1 figure 116:4 116:11 figures 110:4 filed 56:4 filing 45:16,18 financial 126:11 find 55:4 72:10 89:6 92:20 125:3 fine 27:10 Finnish 55:20 firm 5:17 first 8:21 10:17 10:22 16:21 27:21 30:14 32:2,9,10 38:4 45:20 47:6 55:19 57:10 61:19 75:2 88:21 88:21 94:11 95:7,10,10 97:2 114:18 116:5 120:7 122:1 five 6:16 7:16 76:19 fixed 18:6
E E 3:1 4:1 5:1,1 e.g 54:2 earlier 69:10 70:12 71:15 76:22 77:22 78:12 81:1 94:6 103:5 115:15 124:4 124:8 earth 48:15,20 49:17,19 78:4 earths 78:8,10 easier 10:18 13:10 115:21 easiest 95:11 easily 93:10 easy 72:10 93:22 edition 23:19 effect 72:14 79:18 effective 66:15 efficiency 87:6 87:7,9,18 eighth 23:18			F F 1:16 3:3 4:4 5:4 126:4 faced 30:3 facilitate 112:15 Fahrenheit 35:19 fair 6:18 9:17 14:1 17:16 54:11 59:3 62:21 66:10 68:22 72:5 77:12 95:11	

Fleming 6:3	117:15	37:11,12,13	goal 86:18	H
flow 29:7	free 11:1	119:11	87:19	H 4:1
36:21 37:2	friendly 49:10	gel 20:14	goes 24:18	halfway 114:7
84:14,16	49:12	general 24:2	47:21 48:11	hand 10:19
91:16 92:15	front 18:3	43:15,15	53:10 80:22	15:13 23:15
flowing 66:16	56:17,17	58:21 60:3	88:18 97:16	27:10 31:22
fluid 108:14	75:3 110:4	120:19	going 10:15,19	38:2 45:12
fluidized 18:6	fuel 8:9	generally 6:17	11:9 13:11	55:8 73:4
18:21	full 6:2 30:14	42:13 60:6	15:13 16:2	95:13 109:5
follow 30:5	47:6 59:8	gentlemen 8:8	25:14 27:8	handing 23:16
followed 57:6	61:19 92:16	German 4:13	27:10 31:22	handy 13:12
following 41:4	92:20	45:15 46:15	38:2 44:4	16:1
56:13	function 26:16	46:19	45:12 47:3	happen 26:9
follows 5:10	furnace 30:17	give 6:6 7:1,5	48:2 55:5,8	happened
font 30:15	further 62:2	12:8,12	55:18,21	111:18 112:3
footnote 81:15	66:17 106:19	22:20 53:22	59:4 66:13	happens 108:4
Force 8:9	126:7,9	56:14 57:4	73:4 83:1	happy 114:2
forced 24:14	G	60:15 62:3	86:8 92:14	heard 96:5
foregoing	G 5:1	87:21 92:8	102:14 107:6	hearing 70:22
125:2 126:3	gamma- 39:2	124:14	109:5 111:14	heartening
form 24:15	60:19	given 27:4	113:1 114:13	119:22 120:1
29:3 30:8	gamma-alu...	31:14 55:3	116:11	heat 114:13
49:20 75:8,9	17:12,19	93:14	good 24:2 50:7	115:18
106:11	39:8,10 40:9	gives 58:2,14	60:3 107:11	heated 52:13
109:22 112:9	40:15,16	116:10	Googled 74:5	71:6 72:17
119:13	51:10 59:15	giving 26:11	gram 100:11	72:18 111:9
formation 63:7	61:8 62:19	60:20	grams 82:2,4	118:5,11,12
85:9	64:4,5,7	go 6:18 7:9,10	105:14 118:1	heater 36:17
formed 107:16	66:16 69:10	10:17 11:10	118:3	heating 29:6
119:17	76:7 79:5,10	15:9 18:16	great 9:15	69:11,18
forming 27:18	91:6,6 95:3,4	21:8 31:19	107:20	70:2 72:2
32:6 38:9	97:8,13	32:17 39:21	greater 12:7	112:19 114:7
46:5 55:16	100:9,10,21	42:7 46:21	43:4 100:10	114:16,20
73:11 95:21	101:17,18	51:7 54:21	110:13,17	115:4,11
109:17	117:3	55:4 56:9	grounds 14:13	held 30:17
112:11 122:6	gamma-alu...	59:7 62:9	14:20 16:4,9	helpful 7:2
forms 20:11	50:14 51:21	65:5 69:4	group 25:6	heptanol
forth 19:9	51:22 52:3	76:7 87:17	108:10	47:17 105:8
83:18	59:21 66:6	88:22 90:5	guess 47:18	105:17,18
found 9:15	gas 25:3,9,12	92:4,7 95:2	51:9 60:5,19	heptene 94:7
32:18 50:4	25:13 26:2	99:21 106:7	69:19 82:11	105:21
62:12	29:7 37:10	115:21 116:3	114:13	107:21
four 22:20		121:9	117:16	hexane 122:22

hexanes 117:12	hydrogenate 105:18	55:5,5 77:11	inter 5:13 11:4	1:11
hexanol 47:16	hydroxide	85:2 97:13	16:14	iron 22:22
81:19 83:12	33:7,11,14	increases 77:8	interest	isolate 110:11
84:14 85:3	33:19,19,20	77:12	126:10	isomerization
hexene 94:7	34:12 41:3,3	increasing	interested 9:7	12:7,9 39:14
hexenes 82:21	41:8,10 49:3	54:15 75:4	9:8	39:19,22
84:19	49:4 78:1,1	77:14	interesting	40:2,6,10
hey 98:7	hydroxyl 25:6	Indian 47:18	112:18	49:7 77:5,10
high 50:6		47:22 48:4	intermediates	77:13 78:20
109:22	I	indicate 67:16	26:7	issued 122:4
110:11,16	idea 63:17	indicated 19:2	internal	issues 8:15
111:17 112:4	64:17,19	81:9	100:21	59:20
113:11	91:19 113:2	indicates 67:8	internally	it'd 72:9
114:14,20	113:4	indication	41:22	it'll 13:10
115:16	imagination	77:7 104:21	international	
higher 54:2,17	49:22	116:10	4:17 55:10	J
92:15	imagine 49:21	industrial 22:7	introduce	January 1:15
hired 21:18	123:1	22:7 88:2	10:16	1:20 126:5
22:3	immediately	inert 29:7	introduction	126:12
hold 25:11	37:8	influence	27:21	journal 27:12
home 6:6	implementat...	53:19	introductory	32:1 47:18
hot 66:16	50:10	information	24:3	47:22 48:4
Houben-Weyl	important 6:21	52:16 81:5	invention 50:3	Jr 4:16
48:7,8	37:10,15	81:21 86:22	50:6 56:11	July 126:16
hours 80:20	improve 65:20	87:12 116:8	57:1 61:21	jump 22:21
84:6 111:6	97:18	119:9	62:2,4 96:9	June 11:15
hundred 82:15	improved	informed	97:17 110:8	55:12
105:14 121:8	65:16	30:10	inventor 45:20	Junior 23:18
Hung 122:2	impurities	Initially 9:6	122:1	
hydrated	59:13	Inolex 1:8,17	inventor's	K
63:10,16	inaccurate	2:10 5:8,15	55:19	K-O-M-A-R...
hydration 12:8	117:20	5:18,21	inventors	32:3
hydrocarbon	include 13:19	126:8	106:15	Karen 1:22
56:14 57:4	17:21 59:13	inside 36:19	investigating	126:2,14
111:11	included 16:9	57:9	66:21	keep 13:12
121:13	72:7 100:10	insofar 17:18	Investment	16:1 20:16
hydrocarbons	114:10	instance	5:16,18	82:8
62:3	includes 12:21	122:21	involve 17:19	key 25:5
hydrochloric	including	instant 124:20	involved 25:16	kilogram
20:14	110:9	instructs	26:21	21:15 105:22
hydroformul...	increase 48:14	18:16	ionization 25:6	106:2
75:7	48:20 54:19	intend 11:17	IPR 5:14 10:15	kilopascal
		12:21 19:13	IPR2023-010...	43:5

kilopascals 42:22	known 17:3,3 39:3 51:9,16	107:2 108:3 109:14 113:7	114:17	lost 62:10
kilos 105:18	57:12 58:11	113:15,19	long 10:5 20:1	lot 48:22 54:21
knew 106:16	58:18 75:17	Le's 96:17	20:13 36:18	58:17
106:21	94:22	leads 54:16	56:8 58:6	low 28:2 61:14
know 7:8,22	knows 51:10	led 44:22	84:8 96:8	76:4,4
8:1 12:19	57:19 80:8	legal 8:1	104:3 119:1	lower 51:2
31:1,5 35:5	111:18 112:3	length 75:5	120:22	61:15 80:14
36:17,21,22	113:1	121:4	longer 86:2,2	114:17
44:18 46:15	Komarewsky	let's 17:22	86:9,19	Lukas 2:11 3:4
48:5 51:5	4:15 32:2	89:20 92:4	121:6	5:12,17,22
52:4,7,12	34:13,17	95:10,11	look 7:20 8:1	18:14 69:4,8
55:18 59:2	35:2,11	96:22	11:1 15:9,16	89:22 123:13
63:9 64:14	36:10 37:17	lifetime 26:8	15:16 17:22	123:21
66:17 68:18	37:22 38:1	lifetimes 87:1	27:20 30:13	124:17 126:8
69:22 70:9	38:16 43:8	limit 121:14,15	31:19 32:9	
71:11 73:3	43:14 51:3	limitation 68:8	35:10 38:11	M
73:20,22	64:21 65:3	limited 26:7	38:20 42:9	M 2:3 126:7
77:22 79:12	67:4,11 68:5	121:12	51:10 56:10	magnesium
79:15,18	71:16	line 12:2 32:17	60:14 62:9	58:10
80:1,2,3 81:6	KR1 79:6	39:2 41:1	63:18 65:5	main 32:20
81:6,11	100:17 103:5	42:10 44:2	69:13 74:18	maintain 87:7
84:10 88:14	103:13	47:4,15	88:5 94:3,4,9	87:18
89:5,5,10		51:13 57:11	94:9,18 95:7	major 82:10
90:10 91:3,5	L	57:13 59:9	95:9 96:7	making 49:10
91:7,12,13	L-E 95:18	61:20 62:1	109:19	107:7 114:1
91:14 93:9	L.G 4:16 23:18	62:11 74:7	116:15,16	122:22 123:1
93:18 95:5	lab 21:11	119:21	looked 13:22	123:1,5
96:5 99:1,7	106:7	liquid 25:1,2,9	32:15 34:14	manner 72:5
99:11,12,13	larger 21:19	25:11,13	38:16 43:7	March 73:7
99:17,18,18	21:21	26:2 119:13	46:12 51:3	marked 5:2
101:14 102:5	law 5:17	list 17:17 20:1	56:6 64:20	10:14,19
102:17	layer 66:8	20:13,19	67:3,15 68:2	15:14 23:16
103:18 104:5	78:12	lists 57:2	78:12 87:15	27:11 31:22
104:8,9,22	Le 95:18 96:7	literature 30:5	94:5 96:2	38:2 45:14
105:2,11,12	97:5,11,16	30:11 31:14	103:11	55:9 73:4
105:12	98:12,16	101:16	120:14	95:14 109:6
106:17 107:2	99:3 101:10	little 13:12	looking 24:12	121:22
114:3 116:1	101:22 103:3	36:20 51:2	25:5 43:11	mass 36:14
117:14	103:6,7,11	76:21 82:16	49:1 50:5	81:7,7,9,17
knowing 79:20	104:11,14	86:22 87:3	75:1 83:8,10	81:18,18
81:14 103:16	105:6,7	89:20,20	98:10	82:1 83:9,9
104:10	106:14,15	98:17 112:4	looks 78:5	material 8:13
			118:19,21	8:14,17,20

9:22 13:14 82:5,12 materials 9:15 13:19 59:14 math 84:3 matter 1:18 5:13 7:18 8:22 11:18 13:2 14:18 16:15 17:16 22:6 46:6 mean 16:14 34:16 44:14 49:12 112:21 115:10 meaning 114:12 means 51:18 62:14 70:2 measure 107:15 mechanical 61:13 mechanism 24:21 25:5,8 25:11 26:20 37:18 43:16 59:4 mechanisms 24:19 43:13 meet 10:3 memory 15:18 mention 102:6 mentioned 36:14 37:2,2 102:11 met 10:4,7 metal 21:2 48:15,16,19 48:20 49:16 49:17,19 78:3,4 metals 49:19	method 18:5 99:9 101:13 methods 28:1 109:21 methy 108:10 metric 66:18 73:21 74:12 90:20 milliliters 100:11 millimeters 36:18 million 50:9 mind 20:12 23:4 29:21 37:8 53:15 94:2 minimize 40:6 77:4 minimizes 77:9,13 78:19 missed 105:6 missing 15:4,4 15:5 mixed 63:6 mixture 12:8 12:13 24:15 63:1 66:2 81:8 84:13 117:17 modified 59:16,21 79:21 101:15 117:6,7 mole 114:6 molecular 28:2 morning 68:3 motivated 54:6 99:15 116:3 moved 65:2 Multi-kilo	106:4 multiple 85:4 Murphy 2:3 3:5 5:19,19 18:11,13 89:15,17 123:19 124:3 124:16 126:7 N N 3:1,1 5:1 name 5:16 6:2 55:19 79:6 79:11 98:13 named 38:4 45:20 108:18 122:1 nature 91:17 necessarily 33:12 91:7 106:17 need 15:9 18:19 30:11 45:4 72:21 81:6 87:22 89:17 92:14 92:19 93:14 107:18,18 124:11 needed 107:20 needs 7:8 40:19 net 81:8 neutralized 41:2 new 19:20 22:14 45:5 62:21 66:11 nine 96:10 nitrogen 33:18 non-volatile 84:22 normal 121:7	North 5:5 6:8 Northwest 1:19 2:5,13 Notary 5:9 125:14 126:2 note 14:20 notes 126:5 November 27:14 38:12 45:18,19 number 5:14 5:15 10:17 13:5 15:4,15 38:3 45:16 46:22 55:11 73:6 95:15 109:8 110:5 122:1 numbers 10:16 15:3,4 46:22 89:9 96:22 119:15 O O 3:1 5:1 O'Connor 2:12 5:17 126:8 object 40:5 61:20 62:2,4 Objection 18:11 obtain 39:11 67:16 obtained 80:18 96:9 obviously 9:9 18:19 occasionally 21:15 occur 85:7 octanol 47:17 74:11,21 octanol's 12:7	octene 94:7 123:2 offer 11:17 12:22 14:2 19:3,14 offering 15:6 15:19 OFFICE 1:1 officer 126:3 offices 1:18 oh 56:19 89:8 89:19 100:4 100:7 101:4 120:1 oil 96:15 105:15 okay 6:9,14,17 7:2,7,11,13 7:21 8:2,6,11 8:16,21 9:2,5 9:8,17 10:2,5 10:9,14 12:3 12:6,11,14 12:17,20 13:7,10 14:1 14:9 15:13 15:13 16:11 16:18,20 17:14,22 18:1 19:1,3 19:12,16,21 20:2,6,9 21:6 21:8,10,14 21:17 22:1,4 22:14,17,20 23:3 25:4,13 25:18,20 26:1,5,10 27:10 28:5 28:14,18 29:4,8,13,16 29:22 30:6 30:13 31:6
--	---	---	---	---

31:11,22	90:21 91:13	38:9 46:6	organized	35:11 39:21
32:9 34:21	91:22 92:17	55:16 73:12	123:20	46:17 47:4,7
35:6 36:8	93:16 94:12	95:22 106:12	osmium 23:1	51:13 53:14
37:1,14,16	95:10,13	109:17 122:7	outside 36:19	53:15 56:10
37:22 38:21	96:7 99:3,3	opposed	overall 25:19	56:16,18
39:1 40:4,7	99:10,14,17	23:22 49:13	43:13 54:4,5	57:11,13,18
40:21 41:13	99:21 100:4	optimal 71:10	owner 1:9 5:16	59:7,8 61:17
41:16,20	100:7 101:14	optimize 54:22	126:8	61:18 62:9
42:2,9 43:17	101:21 102:8	optimized 91:7	oxidation	62:10 63:18
44:4,10,13	103:10,16	optimizing	56:13 57:3	63:18 64:11
44:18 45:4	104:11,11,16	53:22 54:3,9	oxide 28:6,8	75:2,11,12
46:1,3 48:6	105:16,22	order 71:11	32:20 36:15	78:21,22
48:10 49:9	106:3,14	ordinary 22:5	50:14 51:21	88:9,10,11
49:12 50:2	107:1 112:8	22:9 30:1,3,6	51:22 52:3	88:12,17,18
50:21 51:15	114:4,9	31:6,9 34:8	58:5,15,15	88:18 89:8,8
51:20 52:2,5	115:3,3	36:8 37:16	59:16 61:13	89:9,12,13
52:9,17,20	119:20 120:3	45:9 53:17	62:16,16,19	89:13 90:3,4
53:9,12 54:8	120:6 121:16	54:14 60:6,9	63:2,6,6,14	90:14 92:9
54:13 55:1,8	121:20 123:3	60:13,22	64:7 66:3	96:8,22 97:2
55:22 56:5	oldest 23:6	68:1 70:4,7	76:13 78:13	102:15
56:19 57:18	olefin 57:7	70:16 71:2	98:18 111:4	109:20 110:3
58:22 59:3,3	58:2 75:4	72:13,20	111:15	110:4,21
59:7 60:18	olefins 28:2	73:1 74:15	113:21	114:5 116:16
61:4,10	56:12 57:2	74:20 79:14	oxide-treated	116:17
63:11,18	57:19 58:19	81:10 86:14	77:17	pages 13:13
64:18,20	59:12 96:10	87:10,16,20	oxidizing 62:3	13:18 97:1
65:6 66:10	operate 70:22	88:13 90:9	oxygen 49:20	125:3
67:1,19 68:1	operating	90:21 91:2	oxygens 112:9	papers 67:9
68:13 69:4	84:18 121:7	91:14 93:3		para 20:13
70:4,10 71:2	operation	94:3,8,17,21	P	paragraph
71:11,22	48:11 88:4	97:22 98:3	P 5:1	14:5,8 16:4
72:3,8,19,22	opinion 17:1	99:10 103:3	P-U-R-A-L	16:21,22
73:4 74:3,7,9	18:9 19:3,7,8	103:11,20,20	79:6	17:15 23:5,9
74:14 76:2	19:9 22:4	104:6 107:1	p.m 123:22	24:4,12 33:5
76:21 77:15	29:22 67:1	107:14	124:1,19	35:15 39:7
77:21 78:3,6	74:19 113:15	115:20	126:6	40:21 42:18
78:11,15,21	115:21 116:6	117:19	page 4:2 10:18	47:6,7 50:2
79:14,20	opinions	119:10	10:22 11:7	51:7,13
80:3,7 82:13	11:17 12:21	120:15 121:5	11:19 14:6,7	53:15 57:11
83:11,17,22	14:2,11,17	organic 19:19	16:5,20 23:4	58:20 59:8
84:11 86:4	14:18 15:6	21:4 23:12	24:13,19	61:11,19
86:10,14	15:19 19:13	23:17 24:1,2	26:10 27:13	74:9 75:16
88:1,5 90:6,9	27:18 32:7	24:3	30:14 32:10	76:3 78:22

88:8,10,13	4:9,11,12,13	83:6 109:3	16:14	portion 44:22
89:11,13	5:14,16 7:21	perform	petitioner 1:6	45:2 84:15
90:7 92:9	8:3,7,15 13:3	124:12	5:15	POSITA 54:6
97:1,5,11	13:4,5,8	performed	Petitioners	possible 71:8
98:10 99:22	15:14 16:1	29:5,18	126:7	86:12 93:11
100:2,3	17:1,3,8 18:2	118:20	Ph.D 1:16	potassium
102:15,19	22:6 38:3,18	performing	126:4	41:3,7 49:4
104:15	45:15 50:3	124:6,9	phase 25:1,3,3	78:1
108:16 110:7	53:17 55:10	periods 86:20	25:9,9,12,12	potentially
110:20 114:4	61:5 67:15	111:6	25:13,13	124:5
114:9 115:4	68:10 73:5	person 22:4,9	26:2,2,15	powder 117:3
116:18	73:14 74:2	22:12 29:22	27:22 47:8	practiced
paragraphs	74:17 89:4	30:3,6,8,10	110:10	66:17 116:9
75:11,14	92:22 95:14	31:6,9 34:8	Philadelphia	precedent
102:11	96:2 109:7	36:8 37:16	5:6 6:8	30:5
parameter	117:21	45:9 53:17	phosphoric	precipitate
53:18,19	121:22,22	54:14 60:6,9	26:12	33:17
pardon 112:2	122:4 126:8	60:13,21	phrased 34:15	precipitated
121:21	patents 13:21	68:1 70:4,7	picked 23:22	33:21
parentheses	91:19	70:16 71:2	place 48:12	precipitation
110:12	peculiar 82:16	72:13,20	110:9	33:7
part 35:12	pending 7:10	73:1 74:15	please 6:1,6	precise 107:8
84:22,22	penetrate	74:19 79:14	18:16	precisely 35:5
96:17	41:20 42:4	81:10 86:14	plus 82:15	36:20 93:22
partes 5:13	Pennsylvania	87:10,16,19	point 98:18	106:21
11:4 16:15	5:6	88:13 90:9	100:11	predictable
partial 75:8	pentacarbonyl	90:21 91:2	102:21 113:2	71:4 90:16
92:10	23:1	91:13 93:3	115:18	90:18
partially 96:11	people 31:15	94:2,8,17,21	Polsinelli 1:19	predictably
particular	33:15 44:16	97:21 98:3	2:4 5:20 9:2	54:16
15:17 17:10	49:4 77:19	99:10 103:3	10:3 126:8	preferable
30:4 71:12	85:21	103:11,19,20	polymer 96:9	42:15
72:4 87:12	percent 50:13	104:5 107:1	96:14	preferably
particularly	52:5,18 53:1	107:14	polymerizati...	76:2 100:1,5
47:16 49:6	53:6,8,10	115:20	108:4,14	100:8
98:6 107:5	81:7 83:3,5	117:19	polymerizing	preferred
parties 126:10	83:11,19	119:10,22	96:10	42:11
parts 50:9	84:2 98:18	120:15 121:5	poor 59:15	preparation
party 21:18	107:19	124:11	60:8,10,20	10:2,7,8,10
passed 35:15	110:13,18	personal	61:13	13:20 15:11
passing 85:3	116:22 117:7	126:11	pore 113:8	28:2 66:15
patent 1:1,3,9	119:6	petition 11:4	117:3	79:13,15
1:12 4:3,5,7	percentage	16:11,13,14	pores 100:10	99:9 101:13

115:15 prepare 8:11 prepared 8:18 8:19 11:4 33:6 60:1 86:1 preparing 16:13 presence 97:6 present 28:10 126:7,8 pressure 37:14 42:19 43:4 50:11 50:11 58:1 91:16 102:21 Pressure's 37:15 pressures 42:22 43:3 76:17,18 presumably 66:20 84:8 92:14 105:19 112:6 118:6 presume 30:19 112:21 117:20 119:12 pretty 31:12 119:1 previous 113:2 primary 59:1 62:14 prior 5:2 9:12 9:14,18 16:7 16:8 19:2 31:19 47:11 50:8 59:11 60:14,14 70:14,18 72:12 74:1,3	77:8 78:7 87:15 94:15 106:11 113:3 120:14 124:14 priority 16:22 53:16 89:3 95:10 probably 6:16 7:22 20:15 21:5 22:13 23:2 26:21 28:16 45:1,8 70:2 71:8 103:14 107:9 107:13 108:13 112:9 116:10 117:14,20 118:14 119:19 problem 20:18 problems 59:10 62:19 62:20 proceed 26:19 85:12 proceeded 27:7 36:1 proceeding 18:22 proceedings 1:21 process 17:12 56:12 57:2 62:3,5 69:15 70:14 90:15 90:17 96:17 97:3 116:8 119:22 processes 22:7 59:11 75:17	produce 40:11 57:7 64:2 110:10 produced 54:4 54:5 57:19 62:13 79:5 81:16,17 produces 90:19 producing 56:12 57:2 59:11 89:1 90:11 product 32:20 39:15,15,20 39:20 54:5,7 55:2 67:9,21 80:18 81:18 82:4,5,11 84:1 87:21 107:19,20 production 88:7 97:3 products 17:2 17:7 24:14 49:14 59:13 82:10 93:21 106:19,20 123:6 promote 49:7 promoted 76:8 76:10,22 77:2,15 78:16,18 80:4 pronounce 55:19 proton 20:11 protonation 25:5 28:14 protons 28:17 41:10,12,13 41:17	provide 18:20 62:2,5,6 66:3 116:8 provided 8:13 9:14,18 14:13 48:21 provides 12:10 49:13 109:21 public 5:9 92:1 125:14 126:2 publication 4:5,7,9,17 32:3,11 38:12 45:17 45:19 55:10 55:12,21 56:2,6,11 57:1,10 59:19 60:7 61:11,18 62:11,12,18 66:1 67:5 71:18 73:6,7 73:9 92:1,22 95:15,16 109:8,9,10 110:17 116:7 publications 47:12 67:11 94:5 published 27:14 45:15 46:8 47:12 48:10 55:9 56:4 73:14 74:3 109:7 109:13 Pural 79:6 100:17 103:5 purchase 91:8 99:16 pure 67:12	purity 37:7 67:9,17,18 68:7 69:2 104:1,1 107:15,17 109:1 purportedly 63:7 put 38:1 45:13 115:17 putting 84:12 Q quantity 106:20 question 7:1 7:10 15:19 18:17 20:22 21:1 34:19 38:19 44:12 48:18 53:14 54:2 60:5 69:19 72:16 90:16 97:21 117:16 question's 34:15 questions 104:12 123:14 124:17 quick 15:15 quite 34:15 93:22 103:21 118:14 quote 80:4 R R 5:1 raise 54:20 raising 54:18 ran 92:5 118:21
--	--	--	---	---

range 29:9	17:7 19:19	48:5 71:19	82:9 84:7,11	126:9
30:17 31:11	21:12,19	71:21 108:13	reference 16:2	relates 56:12
31:12,15,16	22:15 23:7	124:4,7	32:11 39:19	57:1 96:9,18
31:20 42:14	27:5 29:17	received 27:13	46:12 47:11	116:21 123:4
42:16,22	36:6 40:10	Recessed 69:6	49:2 54:8	relating 5:13
50:12 65:4,8	75:14 88:15	123:22	64:10 65:15	relative 44:9
114:16 121:7	106:8 113:18	recharged	74:4 88:6	61:14
ranges 42:11	reactive 82:12	84:19	94:4 95:18	relevant 13:22
76:15 114:7	reactivity	recites 18:5	106:15	87:11 88:1
115:5	85:20	recognize	121:21 122:3	94:6
rate 35:16 37:2	reactor 18:6,7	10:20,22	referenced	reliable 66:20
77:8 91:16	18:21 84:13	27:14 32:4	16:12 48:4	reliably 90:20
92:15	84:15 85:1	38:5 46:3	references	relied 14:3
rates 36:21	read 8:13	55:12 95:19	16:8,8 38:16	73:11 95:21
ratio 28:11	13:21 16:17	109:11	68:2 71:15	109:16 122:6
82:6 114:6	46:15 47:22	Recognizing	72:4,12	rely 32:6
reach 120:20	48:3,8 74:1,1	26:6	78:12	122:10
124:12	74:5,17	recollection	referred 78:17	relying 122:14
react 41:10,22	86:22 91:18	15:10 16:3	95:17	remain 86:2,19
reacted 50:19	106:1,11	31:20 69:17	referring 8:16	remainder
85:3	125:2	72:6 123:11	8:17 17:8	108:3
reacting 42:7	readily 29:21	Reconvened	24:7 25:9	remember
reaction 20:7	39:3	69:7 124:1	27:3 32:14	16:18 22:17
21:2 24:15	reading 30:11	record 6:2,7	44:1 46:22	29:20 31:17
25:1,9 27:7	46:19 106:6	7:9,10 69:5,9	51:20 64:14	31:18 65:7
29:15 30:16	reagent 42:2	126:4	67:20 77:17	69:11 72:3
31:13 36:1	50:19	records 7:20	90:17 99:5	remove 29:2
36:10,11	real 120:1	8:1	100:16	41:11
37:3,6,19	really 6:21	recovered	110:17 113:6	removing
42:4 44:14	31:5 36:21	83:10	refers 17:10	24:14 41:13
53:18 54:16	43:5 69:17	recross	17:11 31:2	41:17
57:22 58:6	69:22 75:18	123:16	refinery 8:9	renewable
58:12 60:11	84:17 114:3	recycling 84:9	refresh 15:18	96:11
63:2 80:12	117:14	84:11,12	regard 9:13,15	repeat 116:12
84:12 85:10	reason 7:4	114:19	72:1 73:19	report 39:21
85:14 86:5,9	23:22	redirect	87:21	72:7 74:10
92:2 97:18	reasonable	123:16	regardless	89:7
98:2 102:4	31:4 103:22	reduces 53:11	59:4	reporter 6:20
103:19 105:8	reasonably	reduction 75:8	regimes	126:1,2
112:16	66:20 94:14	refer 13:7	115:11	represent 65:8
120:16 121:6	119:3	15:10 17:15	relate 22:18	103:1
121:17	recall 16:16	38:21 46:1	related 22:5	representative
reactions 17:2	21:5 43:5,7	54:3 55:21	59:10 78:10	9:6

reproduce 106:7 116:8	25:15 28:8 30:21,22	87:6,8 88:17 90:2,5,22	37:6 91:15 92:10	52:17,19 57:18 59:10
require 54:1	33:20 37:21	91:9,10,20	runs 87:20	61:11 62:1
research 66:13	37:21,22 38:1,8,17,20	92:7,12 93:1 93:20 94:2	118:19 120:22	64:11 79:1
researchers 86:18	38:20 40:1 40:12,20	95:12 96:15 96:20 97:14	Ryan 2:3 5:19 10:4 126:7	96:9,14 97:5
residing 5:5	42:16 43:4,9	98:10,11,14	S	98:7 100:8
residual 98:18	44:1 45:12	98:19 100:11	S 3:1 4:1 5:1	103:7 108:15
resources 96:11	46:9,14 47:19 48:16	100:16,18 101:1,2,8	salt 78:10	110:8
respectively 32:21	49:16,18 50:14,22	102:12,19,21 104:2,13	salts 49:5,5,8 77:20	scale 21:6,12
result 39:15 40:10 60:15 66:14	51:4,7,11,21 52:12,14,15 52:18 53:10	105:4,9 106:5,8 108:3,16,22	SASOL 73:15 73:17 74:16 79:5 80:8	21:16,19,22
resulted 34:6	55:6 56:2,3,6 56:22 57:4,7	109:1,5,14 110:3,13	88:22 90:10 91:3,11,15	66:18 73:21
resulting 119:16	58:3,7,12,15 58:19 59:5	111:7,11,14 112:11 113:6	91:18 92:2 95:1,1	74:12 88:3
results 71:3	59:21 60:2 61:1 62:7,16	113:13 114:15,18,21	100:15,17 101:8 103:2	90:15,20
RETAINED 4:21	63:12 64:8 64:22 65:4	115:6,9,13 116:6,22	103:4,12	91:4 104:8
retired 6:5,6	65:10,14,17 65:21 66:10	117:5,9 118:10,10,11	SASOL's 74:20 88:6	105:11,22
reverse 85:11	66:19 67:12 67:17,21	118:15,20 119:1,4,6	sat 6:14	106:2,4
reversible 85:10	68:17 69:1,9 69:19 70:14	120:4,15 121:1,2,10	satisfactory 93:19	scales 21:11
review 5:13 10:9 11:5 16:11,13,15	72:11 73:8,9 73:15 75:5,9	122:4,11,13 123:6,10,13	saw 61:4 91:8 saying 35:15	scheme 63:19
reviewed 13:14,17,19 72:7 87:4	75:10,14,19 76:6,16,19	right-hand 38:11	51:10 53:4,5 59:19 60:3	63:22,22
reviewing 37:17 60:7 87:11 97:22 107:2	77:6,11 78:13 79:7 80:13,16,20	rinsing 112:15 rmurphy@p... 2:7	62:18 65:19 66:2 73:8	se 51:9,16
right 5:12 6:1 7:4 11:5,16 11:21 13:5 13:16 14:3,7 14:22 15:6,8 18:18 23:13 24:11,16	81:14,20 82:1,4,6,17 82:20,21 83:13,18 84:16,20 85:2,14,16	robust 119:3 121:1 room 119:11 roughly 26:3 run 84:8,9 running 29:15	78:15 99:4 says 16:22 24:11,13 27:21 30:16 32:18 33:6 39:7,12 40:22 42:13 47:15 48:14 50:20 52:5	108:19
				search 9:12,19 48:3 72:10
				second 24:13 27:13 50:5 59:8,8 97:17
				secondary 59:1 62:14
				section 11:10 13:14 14:10 24:7,8,22 100:17
				see 11:12,20 13:15 14:11 14:14 16:5 17:4 18:7 23:7,10 24:6 24:9 26:13 28:3 30:18 31:10,20 32:12,21 33:2,9 35:12 35:17,22

38:13 39:4 39:16 41:5 42:11,19 45:21 47:4,9 47:13 51:17 51:19 53:2 53:20 56:15 57:12,20 59:16 60:7 61:15,21 63:19 64:11 68:21 75:13 79:2 95:9 96:12 97:3,9 97:19 100:1 100:19 103:1 103:15 105:7 108:18 111:1 114:8 115:7 116:18 118:17 119:9 119:14 seen 67:14 72:1 80:15 87:3 select 103:12 selective 63:7 selectively 62:13 66:12 selectivity 50:7 52:21 53:1 59:15 59:20 60:8 60:10,20 64:1,8 65:16 65:20 66:5 67:17 72:15 77:12,14 97:13 98:2 110:1,12,16 120:21 sell 95:2 selling 95:4	sense 22:2 69:22 70:20 sentence 16:22 17:21 24:13 27:21 30:15 32:18 35:14 39:12 48:13 50:5 61:10 88:21 97:16 98:6,7 98:9,11 100:1,3,7 separating 84:18 September 109:9 serve 49:8 set 19:9 83:18 95:7 setting 88:2 seven 80:19 84:6 short 123:19 show 16:16 50:1 66:15 80:2 showed 84:1 shows 63:22 64:4 side 49:14 Signature 125:7 silane 111:14 112:5 114:10 115:1 silate 115:17 silica 20:14 silicon 76:5 silicon-oxyg... 112:10 similar 35:4 78:9,16 123:1	simplified 25:17 43:16 single 87:20 SiO 112:11 sit 12:20 17:14 91:22 sites 39:13 40:22 41:1 49:8 77:4 86:7 six 96:10 size 113:8 skill 22:5,9 30:1,3,6 31:7 31:9 34:8 36:8 37:16 45:9 53:17 54:14 60:6,9 60:13,22 68:1 70:4,7 70:16 71:2 72:13,20 73:1 74:15 74:20 79:14 81:10 86:14 87:10,16,20 88:14 90:10 90:21 91:2 91:14 93:4 94:3,8,17,21 97:22 98:3 99:10 103:3 103:11,20,20 104:6 107:1 107:15 115:20 117:19 119:10 120:15 121:5 124:11 slash 55:11 73:6 95:15 109:8	Slow 89:5 slower 92:14 small 30:15 109:3 smaller 82:21 sodium 33:8 41:3,8 49:3 59:16 78:1 98:18 sodium- 59:20 sodium-trea... 60:19 61:6 sold 8:9 solid 26:15 110:10 solution 26:2 33:8 solvent 111:11 somewhat 31:15,20 42:8 43:15 73:18 80:14 107:6 sophisticated 100:20 sorry 16:12 18:15 20:16 21:7 25:20 32:18 40:9 43:21 45:18 51:12 52:21 56:16,17,17 57:10 59:9 62:9 63:21 65:2 82:18 88:10,17 90:1 100:2 117:11 118:7 122:13 124:7 sort 18:22 40:20 70:1,3 113:22 source 20:11	40:18 74:13 sources 39:8 40:15,16,17 speak 33:15 87:2 speaking 6:17 speaks 58:20 78:7 species 25:16 26:21 27:2 28:13 specific 21:1 27:5 29:8,20 44:19 59:22 93:13 101:4 102:17 108:21 113:16 117:3 specifically 17:17 20:12 23:4 43:20 58:20 77:16 78:7 92:2 specifics 60:21 specify 35:19 102:5 108:12 speculation 49:5 spelled 122:3 spent 114:12 114:19 spoken 49:3 standard 18:21 28:1 start 68:18 90:6 105:14 105:17 109:19 118:1 started 64:21 113:20 starting 37:7 44:21 59:14
---	--	--	--	--

82:5,12 100:1 starts 47:7 56:11 57:12 100:5 state 6:1 23:5 statement 17:20 60:13 states 1:1 57:1 62:12 83:2 stenotype 1:22 126:5 step 25:4,6,7 25:14,14,14 26:3,3,3,6 79:2 97:2,6 steps 56:13 57:3 stick 46:20 sticking 49:21 104:11 stoichiometric 28:11 stop 64:16 stream 33:17 50:19 80:20 84:6 85:19 85:19 Street 1:19 2:5 2:13 5:5 6:8 Strem 117:4 strength 61:13 strictly 41:18 65:3 strong 124:15 structure 100:21 101:17 111:18 113:4 113:5 114:3 study 49:22 stuff 52:15 107:18 109:4	113:1 stuff's 101:5 subject 7:18 17:15 22:5 Subscribed 125:9 subsequent 41:4 66:16 67:15 77:9 78:19 123:5 substantial 106:18 substantially 35:2 substrate 27:7 success 94:15 124:15 successful 36:7,22 71:1 94:14 sufficient 44:20 45:6 87:21 106:20 107:7 sufficiently 44:11,13,14 suitable 39:10 42:14 Suite 1:19 2:5 sulfate 58:10 sulfuric 26:12 sulphonic 20:14 summarize 14:16 Summary 14:10 superior 67:8 67:18,19 68:6,7 supply 106:18 107:8 support 11:4	76:5 supported 30:16 supporting 49:1 suppose 86:12 121:8 123:12 sure 7:3,12 11:2,8 13:9 18:4 34:15 37:15 38:22 46:2 51:18 56:1 80:8,9 84:3 86:21 106:5 108:12 120:19 123:18 surface 28:12 28:15,16 39:7,12,14 41:1,8,11,12 41:14,18 49:22 52:13 63:10,16 111:15 112:5 112:7,9,12 112:17 surprise 64:6 sworn 5:9 125:9 126:5 Symrise 1:5 2:2 5:15,20 10:19 124:2 126:7 synthesis 24:8 T T 3:1,1 4:1 55:20 Taber 1:16 3:3 4:2,4 5:4 6:3 6:9 19:17 46:15 124:4	126:4 table 13:13,17 14:14 80:17 80:17 81:3 81:13 82:8 83:2,18 84:6 118:16 119:9 take 7:7 15:15 15:16 17:22 43:12 116:3 123:19 taken 1:18,21 126:3,5 takes 48:12 talk 6:21 25:4 27:2 33:17 39:21 44:16 76:7 77:19 80:9 87:2 100:12 105:3 108:4 113:3 114:16 123:11 talked 21:20 69:10 70:12 76:21 77:3 77:22 78:2 78:12 81:1 113:7 talking 13:4 21:3 22:10 26:15 28:7,8 40:12,13,15 50:4 69:20 94:4 105:3 talks 39:2 58:5 58:9 74:10 76:15 80:12 81:16 113:19 task 30:4 taught 65:15 teaching 40:7 40:9 43:12	50:17 technology 47:19 48:1,4 73:15 74:16 75:21 tell 81:2,22 telling 104:3 temp 36:10,11 temperature 29:8,9,11,11 30:17 31:11 31:12 37:7 42:11,13 44:17,20 45:6 50:22 54:15,18,20 55:6 58:1 61:15 65:4 71:6,7,8,10 76:15 80:14 91:16 92:15 102:20 111:5 113:12 115:16 118:6 118:7,8,10 119:12 temperatures 42:15 48:12 50:12 51:3 54:2 111:17 112:4 114:8 114:14,17,20 ten 6:13 7:14 46:11 53:8 56:5 66:2 105:18,18 term 28:18 44:9 70:2,21 77:18 110:16 terms 14:1 21:10 36:1 37:1 43:7 87:6 120:12
--	--	--	--	---

122:9	88:1,7 91:9	toluene 20:13	treatment 41:2	36:20 37:8
tertiary 59:2	92:8 95:17	ton 66:18	52:13 65:16	102:6,10,10
test 87:17	101:1 103:19	73:21 74:12	113:12	115:10,11
testified 5:10	108:6 111:21	90:20	114:10 115:1	117:7
testimony 7:5	112:18 113:7	top 26:10	115:1	type 31:13
124:5,8	114:18	30:13 38:11	TRIAL 1:3	37:6,11,12
tetracarboxy...	116:15	47:1 57:16	trichlorosila...	60:22 86:5
22:22	121:20 122:2	57:18 63:22	111:13	typical 31:12
tetrachloride	third 21:18	64:10 66:10	triflic 20:15	typically 29:4
63:3 66:7	thought 49:4	78:22,22	triflow 20:15	29:9 70:11
text 24:3	92:4	84:5 90:14	trilobed 98:17	70:13,17
textbook 4:16	thousand	97:1 110:5	99:4	76:19
23:12,18	111:6	total 82:4 83:8	true 68:10 98:5	U
24:1	three 22:20	83:9	119:19 125:4	U.S 1:12 4:3,5
thank 56:21	26:8 28:11	track 62:10	126:4	4:7,9,11,12
123:13,16	82:10 118:19	trade 79:6,10	truthful 7:5	5:14 13:5
124:18	tied 73:2	98:13	try 89:20 94:11	15:14 38:3
Theodore	time 6:14	TRADEMARK	94:19 103:14	73:5 95:14
45:21	20:16 29:11	1:1	106:7 116:3	109:7 121:22
theta- 64:5	44:16,19	transcribed	116:4 119:22	ubiquitous
they'd 103:14	45:6 51:6	1:22	trying 29:19	103:19
107:4	58:6 71:6,7	transcript	89:6	uh-huh 11:22
thin 66:8,8	71:10 85:18	126:3	tube 30:17	68:11 74:19
thing 55:20	85:19 86:11	transition 20:3	37:3	93:12 95:6
56:9 70:3	86:13,16,20	transitional	tubular 36:17	101:19 108:1
95:11	104:10	21:1	Tuesday 1:15	118:4 119:7
things 26:8	118:13	translation	1:20	undergo 42:4
36:21 60:16	123:14,17	46:16,21	Tungsten 21:3	understand
70:1,20	times 6:12	47:1	turn 11:7 14:5	6:18 30:1
91:16 93:8	7:14 85:4	treat 39:10	16:20 23:3	31:7 37:18
120:2	titanium 58:15	43:12 50:17	24:6 39:1	45:10 53:5
think 9:4 10:15	76:6	66:4,6	53:12 57:9	53:18 54:15
10:18 13:11	titled 13:14	112:19	61:17 75:11	67:10 70:5
16:2 24:7	14:10 33:5	115:16 118:2	78:21 96:22	70:17,19
26:12 31:6	38:3	treated 40:19	102:14 110:3	71:3 72:16
44:1 46:10	today 5:12 7:5	43:18 52:1,1	110:4	72:21 86:15
50:2 61:4	10:2,8,10,16	52:3,7,12	turning 13:11	88:14 90:10
64:16,21	12:20 17:15	80:4 101:15	15:22 16:3	103:4
70:5,11	64:20 71:16	111:5,9,10	35:10 50:3	understandi...
71:16 73:7	76:22 91:22	112:21	turnover 87:3	24:22 25:8
74:9 75:2	123:17	113:11 114:1	87:5	31:2 32:14
76:21 78:11	today's 8:12	treating 44:22	turnovers 87:1	33:13 34:2,5
80:22 81:21	told 120:5	77:3	two 8:8 28:11	

34:9,11 35:1 39:18 50:16 54:14 60:9 60:18 63:5 68:3,5 77:1 77:16 78:18 83:17 90:19 98:1,21 99:5 100:20 101:21 110:15 understood 90:16,18 undesired 39:15,20 40:3,14 49:14 undoped 98:17 99:4,5 UNITED 1:1 units 36:3 unmodified 79:21 98:22 101:15 unreacted 84:15 untreated 95:3 use 23:19,19 30:1,8,12 31:12 66:2 71:21 86:6 87:12 89:17 94:22 99:16 102:6 122:15 useful 60:17 113:17 user 49:10,12 uses 79:4 92:3 usually 21:16 54:6 83:8 87:2 98:18	v 1:7 5:15 V-O-E-S-T-E 45:21 V.I 32:2 vague 60:16 validity 14:17 15:7,20 18:9 19:4 vapor 27:22 47:8 variables 36:13 37:1 various 20:10 vary 40:18 varying 53:18 vegetable 96:15 velocity 27:5 vendor 95:1,4 version 97:17 versus 64:8 69:20 vertical 30:17 vessel 37:3 view 60:10 87:11 viewing 68:2 Voeste 45:20 45:21 46:1,8 50:3,17 51:8 56:6 65:19 66:2 67:4 71:18 Voeste's 50:21 volatile 84:21 93:21 107:6 121:9 volatility 121:12 volume 100:9 117:3	W-R-I-G-H-T 109:10 W-U 38:5 W.G 27:12 Wade 4:16 23:10,15,18 23:19,20 24:2,5,13,18 24:22 26:10 37:19,20 want 15:15,18 16:1 17:6 40:6 56:9 68:21 81:11 88:5 92:13 107:2 109:2 119:14 wanted 24:6 60:15 78:21 95:13 wash 43:22 115:17 118:2 washed 111:10 washing 41:4 49:3 112:14 Washington 1:14,20 2:6 2:14 5:18 126:12 water 28:16 29:2 41:4,11 58:3 81:16 81:17 82:1 110:9 112:15 112:20 116:22 way 18:22 24:16 44:18 44:22 67:2 77:4 78:5,9 79:20 80:3,5 81:1,13	94:10 101:5 103:16 104:3 104:9,22 105:2 112:7 114:1,14,17 121:18 123:1 ways 75:22 we'll 7:7 109:19 we're 5:12 10:15 13:4 13:11 16:2 21:3 22:10 26:1,1,2,15 28:7,8 43:3 43:11 47:3 56:16 69:9 88:17 94:4 105:3 118:3 we've 19:18,19 49:3 62:20 64:20 67:3 67:15 68:2 80:15 120:14 weighed 119:13 weight 28:2 84:1 116:22 117:9 went 83:12 Weyl 48:8 white 120:6 WHSV 64:11 64:14 withdrawn 16:3,12 40:8 52:21 56:22 59:10 70:12 83:2 witness 3:2 18:12 89:16 89:19 123:18 125:7 126:4	WO 4:17 55:11 wonder 31:10 116:13 wondering 74:13 word 70:22 71:21 72:1,9 72:10 73:2 words 12:6 84:14 work 22:18 60:16 66:16 93:8 98:4 103:17 104:2 104:3 120:6 121:6,17,18 worked 8:6 9:2 16:10 19:21 20:5 21:11 21:15,17 22:14 31:10 60:15 103:15 105:13 120:3 working 22:10 70:8 104:8 116:2 works 61:3 84:3 91:8 99:13,18 101:9,10 103:7 121:17 wouldn't 17:14 60:21 99:12 108:10,22 121:14 Wright 109:10 109:10,16,20 110:16 116:7 116:16 writing 6:20 117:21 written 11:9 37:20
V	W			

wrong 8:10 69:18 73:8 89:16,19 123:12 Wu 38:5,21 39:1 40:7,9 42:10,21 43:11,14,18 45:13 46:11 51:4 61:5 65:15 67:4 71:16	years 6:16 7:16 21:4 38:15 46:11 56:5 66:2 89:2 90:12 yesterday 10:7 yield 32:20 48:14,20 54:1,3,4,9,17 54:19,19 55:2,5 67:8 67:18,19,20 68:6,12,15 68:17 72:15 81:2,6,11,22 83:1 93:4,7 97:18 98:2 103:22 104:1 104:20 105:1 105:3,3,12 106:16 107:2 107:8,11 119:5,18 120:2,7,10 yields 68:9 93:18,18 Young 1:22 126:2,14 Yulin 38:5	111:19,20 0 0065389 73:6 01 55:11 01/44145 4:18 0196114 95:16 0238788 109:8 04 17:1 98:18 048 13:7 16:1 17:2,8 18:2 22:6 53:16 68:10 89:3 1 1 14:13,20,21 16:4,9 17:21 25:4,14 26:3 26:6 32:18 35:11 56:10 56:16 63:19 63:22,22 64:2 75:12 79:1 110:21 116:18 118:16 120:17 1-59:14 62:4,5 1-alcohol 30:7 85:13 120:20 1-alcohols 23:6 58:18 1-alkene 30:8 54:11 68:20 69:2 96:19 109:2 1-alkenes 66:15 108:21 120:20 1-alkenol 42:3 42:6 1-butane 118:9	1-butanol 116:21 118:9 1-decanol 64:1 1-heptanol 104:22 1-heptene 104:20 105:4 106:18,21 107:5,15,19 1-hexanol 32:19 79:1 80:19 83:9 83:10,19 84:2 93:1,5,9 1-hexanol's 82:11 1-hexene 32:20 82:10 83:20 92:18 94:1 106:18 107:5 1-octanol 17:11 32:19 73:21 89:2 93:6,9 1-octene 17:11 32:21 40:2,5 73:21 74:11 74:21 88:7 89:2 90:11 90:20 107:6 122:18,19 1,100 114:21 1,2-alkanedi... 122:16 1:06 124:1 1:07 124:19 126:6 10 4:4 14:21 80:17,17 81:3 82:8 83:2,18 84:6 10,995,048	1:12 4:3 5:14 15:15 10:03 1:20 126:6 100 42:22 58:1 82:4 1001 4:3 15:14 1002 4:4 10:20 53:13 1007 4:5 95:14 1008 4:7 73:5 1009 4:9 109:6 1010 4:11 121:22 1025 4:12 38:2 38:7,9 1026 4:13 45:14,14 46:5 47:3 1028 4:14 27:11 30:14 32:15 1029 4:15 32:1 1030 4:16 23:17 1035 4:17 55:9 55:15 109 4:10 11 15:2,5,7,17 15:20 17:16 17:18,19 47:15 62:11 11,095,048 13:5 11:22 69:6 11:36 69:7 110 98:14 11th 95:17 12 36:18 12:38 123:22 1200 2:13 122 4:11 123 118:22
X X 4:1 Y Y-U-L-N 38:5 yeah 7:17 11:2 12:1 18:13 18:15,15 20:21 36:5 37:9,22 46:20 52:7 57:14 59:8 60:5 66:8 74:8 76:10 76:14,18 78:11 80:9 82:6 84:3,21 85:18 87:10 88:18,20 92:7 98:9,12 100:7 101:7 102:10,13 108:15,17,20 112:1 114:22 117:22 118:12 119:2 121:3,19 123:21 year 9:1 109:14	Z zeolites 58:10 zero 76:18,19 zinc 111:4,15 111:21,22 112:1,2 113:20 zirconium 61:12 62:16 62:19 63:1,3 63:6,9,14 64:5,6 66:3,6 76:6 78:9,13			

124 3:5	2	2023-01035	114:8 115:5	44145 55:11
13.7 82:2	2 25:6,14 26:3	5:15	118:1	45 4:13 53:15
1401 1:19 2:5	26:6 30:13	2024 1:15,21	31 126:16	89:13 93:10
145 55:21 56:2	30:16 33:1	126:5,12,16	312 24:5,8,13	94:5
56:10 57:1	39:1 40:3,22	20th 109:9	313 24:19	450 42:16
57:10 59:19	42:10 44:2	21 15:2,5,7,17	26:10	76:16
60:7 61:11	47:4,7 51:13	15:20 17:16	314 24:5	47 88:8,9,10
61:17 62:11	102:15,16	17:18,19	32 4:15	88:13 89:11
62:12,18	110:3,5,21	114:9 115:4	33 16:21,22	90:7
66:1 67:5	114:5 116:17	22 14:21 114:4	17:15,21	48 111:6
71:18	2-alcohols	23 1:15,21	34 11:19	5
15 4:3 59:9	59:14 62:4,6	4:16 39:2,21	116:18	5 3:4 47:4
15th 27:13	85:12	41:1	345 102:20	61:17 79:2
16 110:7	2-alkene 40:14	23rd 5:5 6:8	35 23:5 24:4	50 21:4 42:10
17 82:20	2-alkenes	126:5	43:21 44:2	500 42:14
171 102:15,20	40:11	24 111:6	350 33:18 34:5	55 4:18
104:15	2-heptene	24th 73:7	35:16 36:1	557 32:10
172 104:17	108:9	25 53:14,15	36:10 48:13	35:11
173 104:19	2-octene 40:3	250 76:16	58:2 65:4,9	568 5:5 6:8
178 108:16	40:11	26 82:15 88:10	76:16	6
18 116:22	20 23:4 50:9	88:11,12,17	36 75:11,14	6 13:13,18
18th 38:12	125:10	88:18 89:8	360 115:5	14:5,6,8,13
19 16:21	200 42:14	89:12,14	37 75:12,14,16	14:20,21
110:20	76:16	26.57 84:1	76:3	16:4,5,9 18:6
19130 6:8	2000 56:4	27 4:14 88:17	38 4:12	46:17 64:11
1938 30:14	20005 2:6	88:18 90:14	380 30:18 36:2	6,528,665 4:11
1940s 66:13	2001 55:12	28 14:21	36:11 118:6	122:1
66:14	56:3,4	280 50:12,22	385 115:5	62 97:2
1944 27:13,14	2003 122:4	118:3	3915493 4:13	626-8373 2:8
37:21 67:9	20036 2:14	29 51:13	45:16	63 97:5
67:10 93:10	2005 73:6,7	290 80:13	4	64 98:10
93:19 94:5	101:1	29th 126:12	4 12:2 59:7	102:11
100:22	2005/0065389	3	61:20 96:22	66 11:20,21
1945 32:4	4:8	3 25:7,14 26:3	97:2 116:17	100:3,4
37:21 67:9	2011 95:15,17	26:6 57:11	4,234,752 4:12	102:11
93:19 100:22	100:19	57:13,16	38:3	67 78:22 92:9
1972 47:12,13	2011/0196114	75:11,12	40 36:17	68 92:9
1980 38:13	4:6	116:16,17	400 30:18	7
65:15	2012 109:8,9	30 38:15 43:20	36:11 48:13	7 15:2,4,7,16
1989 45:17,19	2012/0238788	76:18	65:4,9	15:17,20
1990 45:18,19	4:10	300 42:16 50:9	420 114:8	
46:8 65:19	202 2:8,16	50:12,22	115:5	
19th 2:13	2023 11:15			

17:16,18,18 17:22 18:5 19:6 7-10 24:8 7-4 24:21,22 25:5 700 42:22 72 11:7 73 4:8 76 82:15 76.5 80:19 82:14 83:3,5 83:19 7th 11:15				
8				
8 13:13,18 14:7,21 16:5 62:1,9,10 78:21,22 92:9 102:15 102:21 800 1:19 2:5 111:5 114:20				
9				
9 57:11,13 63:19 100:11 90 53:1,6 912-4800 2:16 92 110:13,17 94 107:12 95 4:6 96 119:6 97 107:12 98 52:18 53:10 107:19 119:6 99.8 50:13 52:5				