

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
3 - - - - - x
4 MICRON TECHNOLOGY, :
5 INC., :
6 Petitioner, : Case IPR2025-00189
7 v. : U.S. Patent No.
8 YANGTZE MEMORY : 11,145,666
9 TECHNOLOGIES COMPANY, :
10 LTD. :
11 Patent Owner. :
12 - - - - - x
13 Remote Deposition of JACK C. LEE, Ph.D.
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Remote Deposition of JACK LEE, Ph.D., held
pursuant to notice, before Anita M. Trombetta, a
Certified Shorthand Reporter in the State of
California, RMR, CRR, and Notary Public in and for
the State of New York.

1 A P P E A R A N C E S

2

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21

22

-----I N D E X-----
WITNESS - JACK LEE, Ph.D.

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Exhibit 10	Transcript of Jack C. Lee, Ph.D., Dated October 30th, 2025	10
Exhibit 11	'838 Patent	17

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

2 THE COURT REPORTER: Before we begin, do
3 all counsel stipulate to the identity of the
4 witness?

5 ATTORNEY HERMAN: Yes.

6 ATTORNEY WATSON: Yes.

7 J A C K C. L E E, P h.D., called as a witness,
8 having been first duly sworn by a Notary Public,
9 was examined and testified as follows:

10 EXAMINATION BY

11 ATTORNEY WATSON:

12 Q Good morning, Dr. Lee.

13 A Good morning.

14 Q Can you please state your full name for
15 the record.

16 A Jack C. Lee.

17 Q And can you please state your home address
18 for the record?

19 A 5803 Westslope, it's one word --
20 W-E-S-T-S-L-O-P-E; Cove, C-O-V-E; Austin, Texas
21 78731.

22 Q And where are you currently located,

1 Dr. Lee?

2 A Austin, Texas.

3 Q Are you currently at your home address?

4 A Yes.

5 Q Do you understand that your testimony
6 today is under oath and under penalty of perjury?

7 A Yes.

8 Q Is there any reason you cannot provide
9 full and truthful testimony today?

10 A No.

11 Q Do you have any materials with you at this
12 moment?

13 A No.

14 Q Do you have any documents or notes in
15 front of you?

16 A No.

17 Q Is there anyone else in the room with you?

18 A No.

19 Q During this deposition, I would ask that
20 you do not put any documents in front of you
21 besides those that we are marking or putting up as
22 exhibits. Is that fair?

1 A Yes.

2 ATTORNEY WATSON: Can we take a quick
3 break. My realtime is not working.

4 (An off-the-record discussion was held at
5 this time.)

6 Q Dr. Lee, what did you do to prepare for
7 your deposition today?

8 A I reviewed my reply declarations that you
9 uploaded onto the link. I have also reviewed the
10 exhibit listed in my declaration, including the
11 prosecution history and the prior arts that I
12 listed in my declaration. And I also reviewed and
13 considered the material listed in my prior
14 declaration, the board's institution decision, the
15 patent owner response, the transcript of my
16 deposition in this proceeding, Dr. Giapis's
17 declaration, again, as well as the material listed
18 in the table in paragraph 6 of my reply
19 declaration.

20 Q You mentioned reply declarations. Did you
21 review multiple reply declarations or just
22 declaration in this proceeding?

1 A I'm sorry. Just one, the Exhibit 1027
2 that you uploaded on to the link.

3 Q Did you meet with anybody in preparation
4 for today's deposition?

5 A Yes.

6 Q Who did you meet with?

7 A I met with counsel, Mr. Patrick Herman a
8 couple times.

9 Q When did you meet with Mr. Herman?

10 A One last week, I believe it's on Thursday,
11 and once yesterday.

12 Q About how long were each of those
13 meetings?

14 A I don't recall exactly. Maybe one hour
15 each or less.

16 Q And were these meetings in person or by
17 videoconference?

18 A It's via, I believe it's Zoom
19 videoconference.

20 Q Did you meet with anyone besides
21 Mr. Herman in these meetings?

22 A No.

1 Q In preparing for your deposition today,
2 have you discussed the content of your
3 declarations with anyone other than Mr. Herman?

4 A No.

5 Q Now, Dr. Lee, you have been deposed
6 multiple times, correct?

7 A Yes.

8 Q When was the last time you were deposed?

9 A I don't recall. I don't recall. Probably
10 a month ago. I don't recall exactly when.

11 Q And was that in a matter where you
12 represented Micron?

13 A I don't recall which case it was.

14 Q How many cases are you currently acting as
15 an expert witness in?

16 A I haven't recently looked at how many
17 number of cases that I'm currently involved in.

18 Q Would it be more than five cases?

19 A Possibly. I don't -- like I said, I don't
20 recall exactly because some cases are in a holding
21 pattern, and some cases are a little more active.

22 Q Siting here today, you don't know how many

1 cases you're acting as an expert in -- witness in?

2 A No, I don't have an exact count.

3 Q Do you have an estimate?

4 A I probably signed up for more than five at
5 this point. But like I said, some of them are in
6 a dormant state.

7 Q And Dr. Lee, do you remember being deposed
8 by myself back in October of this year?

9 A I think you have deposed me multiple
10 times. I don't remember exactly what date.

11 Q But you and -- I have deposed you a few
12 times already, correct?

13 A I believe so.

14 Q And in one of those instances, I deposed
15 you about your opinions regarding a U.S. Patent
16 Number 12,010,838, correct?

17 A I don't remember exact number. I think
18 you're right.

19 Q Okay.

20 ATTORNEY WATSON: I'm going to drop in the
21 chat what we will mark as Lee Exhibit 10.

22 (Lee Exhibit 10, marked for

1 identification.)

2 Q Dr. Lee, can you please pull up what we've
3 marked as Lee Exhibit 10.

4 A Okay. Yes.

5 Q Do you recognize what is provided in Lee
6 Exhibit 10?

7 A On page 2 of the document indicates that
8 this is a transcript for the deposition of me via
9 videoconference on October 30th, 2025, regarding
10 the IPR proceedings of U.S. patent 12,010,838.

11 Q Dr. Lee, if I use the term "the '838
12 patent," will you understand that to mean U.S.
13 Patent Number 12,010,838?

14 A Yes.

15 Q So Lee Exhibit 10 is your deposition
16 transcript regarding your opinions for the '838
17 patent; is that fair?

18 A I'm sorry. You keep referring to Lee
19 Exhibit 10. All I see is the identification of
20 Lee, Jack C. 103025, full size.PDF. I just want
21 to make sure that we are calling -- we are talking
22 about the same thing.

1 Q Yes. Yes. So I've marked this Lee Jack
2 103025 as Lee Exhibit 10.

3 In fact, let's -- let me ask if we can get
4 the tech team to put a marked version into the --
5 into the chat and we can all be looking at the
6 same --

7 THE EXHIBIT TECHNICIAN: Stand by. I'm
8 putting the marked version in the chat.

9 ATTORNEY WATSON: Okay. Exhibit 10 is in
10 the chat.

11 THE WITNESS: This is the same thing,
12 right?

13 ATTORNEY WATSON: Correct.

14 THE WITNESS: Thank you.

15 Q All right. So Dr. Lee, what we've marked
16 as Lee Exhibit 10 is your deposition transcript
17 regarding your opinions of the '838 patent?

18 A Yes.

19 Q Have you had a chance to review this
20 deposition transcript before today?

21 A Vaguely. I don't recall when I reviewed
22 this, but, yeah, I think I have reviewed this

1 transcript after the deposition of October 30th,
2 2025.

3 Q And were you under oath for this
4 deposition in -- strike that.

5 Were you under oath when you provided the
6 testimony listed in Lee Exhibit 10?

7 A Yes.

8 Q Did you understand that your testimony
9 given in Lee Exhibit 10 had the same force and
10 effect as if given in court?

11 A Yes.

12 Q And to the best of your knowledge, does
13 this deposition transcript in Lee Exhibit 10
14 accurately depict your sworn testimony?

15 A I haven't reviewed this in detail, and I
16 don't recall if I found any error in this -- in
17 this transcript. So I don't know if there is any
18 inaccuracy in this transcript.

19 Q But sitting here today, you're not aware
20 of any inaccuracies in your testimony in Lee
21 Exhibit 10?

22 A You can say that. Like I said, I don't

1 recall if there is any error. I'm sure there will
2 be some typo and some grammatical mistake. So --
3 but at this point, I don't recall any substance
4 [sic] error.

5 Q And during this deposition that was
6 transcribed in Lee Exhibit 10, did you have an
7 opportunity to hear and respond to each question
8 posed by counsel during that deposition?

9 A I'm sorry. Can you repeat that question,
10 please?

11 Q During the deposition that was transcribed
12 in Lee Exhibit 10, did you have an opportunity to
13 hear and respond to each question posed by counsel
14 during the deposition?

15 A Yes, I believe so.

16 Q Are you aware of any inaccuracies in your
17 testimony in Exhibit 10?

18 A I'm not aware of any inaccuracy of my
19 testimony.

20 Q Dr. Lee, could you turn to page 132, line
21 12 of Lee Exhibit 10?

22 A What page is this?

1 Q 131.

2 A 131. So PDF page number 132?

3 Q Correct.

4 A Yes.

5 Q And you can turn to line 12.

6 A Yes.

7 Q In your deposition in Lee Exhibit 10, I
8 asked you if you were aware of any differences
9 between the specification of the '666 patent and
10 the '838 patent, correct?

11 A That's what it says there.

12 Q And you answered that you had never
13 compared the '838 and the '666 patent?

14 A I didn't say I never compared. I said I
15 have not compared it directly.

16 Q So you have compared the '838 patent and
17 the '666 patent?

18 A I'm not sure what you mean by "compare."
19 Are you saying that the specifications or the
20 claims? Obviously, they're two different patents.

21 Q Fair enough.

22 Are you aware of any differences in the

1 specification between the '838 and the '666
2 patent?

3 A Would you mind upload the '838 patent and
4 the '666 patent?

5 ATTORNEY HERMAN: I'll also note that the
6 '838 patent is not of record in this particular
7 proceeding, and I don't believe the board's rules
8 allow you to submit additional exhibits beyond the
9 deposition transcript of the witness.

10 ATTORNEY WATSON: That's fair.

11 Q So Dr. Lee, are you aware, sitting here
12 today, of any differences in the specification
13 between the '838 and the '666 patent?

14 A If you can upload the '838 patent and '666
15 patent, I can look at it.

16 ATTORNEY WATSON: Let me put in the chat
17 the '666 patent real quick. That is Exhibit 1001.

18 Q Let me know when you have that.

19 ATTORNEY WATSON: I will also put into the
20 chat what we will mark as Lee Exhibit 11.

21 A Got it.

22 ATTORNEY WATSON: And then if you could --

1 the tech could put a marked version of Lee
2 Exhibit 11 into the chat.

3 THE EXHIBIT TECHNICIAN: Stand by.

4 ATTORNEY HERMAN: And, again, I object to
5 that exhibit as inappropriate given the board's
6 rules.

7 ATTORNEY WATSON: That's fair, but he did
8 ask for it, so I want to make sure he has the
9 material he wants to answer my question.

10 (Lee Exhibit 11, marked for
11 identification.)

12 THE EXHIBIT TECHNICIAN: Exhibit 11 is in
13 the chat.

14 Q Okay. Dr. Lee, what is what we've marked
15 as Lee Exhibit 11?

16 A It's the '838 patent.

17 Q Okay. So you now have the '838 patent and
18 the '666 patent, correct?

19 A Hold on one second.

20 Okay. Yes, I have both.

21 Q Dr. Lee, sitting here today, are you aware
22 of any differences between the '838 patent

1 specification and the '666 patent specifications?

2 A So obviously the filing dates are
3 different, and all the related dates are
4 different, prior publication data and related U.S.
5 application data. The figures appears to be the
6 same -- the figures appear to be the same between
7 the two patents.

8 The formats are slightly different. In
9 other words, if you look at certain column at
10 certain lines, they're not the same paragraphs.

11 Q Maybe I can short-cut this a little bit if
12 that would be okay, Dr. Lee.

13 A Sure.

14 Q Okay. Are you aware of any differences in
15 the figures between the '838 patent and the '666
16 patent?

17 A Skimming through this, there might be some
18 differences, but skimming through Figure 1 through
19 9 of both of them, they appear -- they appear to
20 be the same.

21 Q And similarly, are you aware of any
22 differences in the description provided in the

1 specification between the '838 patent and the '666
2 patent?

3 A What do you mean by "description"?

4 Q Are you aware of any differences in the
5 written description provided in the '838 patent
6 and the '666 patent?

7 A Do you mean the specifications?

8 Q Yes. Other than, you know, formatting or
9 column number.

10 A The specification starting from
11 "Background" to "Brief Summary" to "Brief
12 Description of the Drawing," "Detailed
13 Description," they all appear to be the same.

14 Q So sitting here today, you're not aware of
15 any differences between the specification in the
16 '666 patent and the '838 patent, correct?

17 A Like I said, I have not compared in detail
18 of the two patents, the '666 patent and '838
19 patents. There might be some difference, but
20 skimming through these two patents at this point
21 just right now, I'm not aware of any difference in
22 the specification between the '838 patent and the

1 '666 patent?

2 Q Sitting here right now, you're not aware
3 of any difference between the specification
4 between '838 patent and the '666 patent, correct?

5 A Like I said, based on what you upload on
6 the chat and based on what I just skimmed through
7 the two patents, they look the same. The
8 specification look the same.

9 Q You can put all those -- you can put those
10 exhibits away or close them if you want.

11 A Okay.

12 Q Dr. Lee, how many declarations did you
13 prepare for this proceeding?

14 A Can you explain what do you mean by
15 "proceeding"?

16 Q Sure. So do you understand that today's
17 deposition is regarding U.S. Patent Number
18 11,145,666?

19 A Yes.

20 Q And we've been using it as a shorthand,
21 but you'll understand that when I refer to the
22 '666 patent, I'm referring to U.S. Patent Number

1 11,145,666?

2 A Yes.

3 Q And when I refer to the term "proceeding,"
4 I'm referring to IPR 2025-00189, which is Micron's
5 IPR regarding the '666 patent. Does that make
6 sense?

7 A Sorry, where did you read that number?

8 Q Sure. Let's pull up -- well, let me --
9 let me do this.

10 ATTORNEY WATSON: I'm going to put up on
11 the screen what we'll -- what has been already
12 marked as Exhibit 1003 and Exhibit 1027.

13 Q And I'll put it on my screen so you can
14 see what I'm referring to if you would like.

15 Dr. Lee, can you let me know when you have
16 Exhibit 1003 and 1027 open.

17 A I just downloaded 1003.

18 Q Okay.

19 A Yeah. I'm sorry. Did you have a
20 question?

21 Q Do you have Exhibit 1003 and Exhibit 1027
22 open?

1 A Yes.

2 Q Let's start with Exhibit 1003. What is
3 Exhibit 1003?

4 A Well, as you've shown in -- on the screen
5 here, this is a -- this is my declaration in
6 support of the petition for IPR of the '666
7 patent.

8 Q And do you see where it says "Case No.
9 IPR202500189"?

10 A Yes.

11 Q If I refer to "this proceeding," can we
12 agree that we're referring to this particular IPR?

13 A I don't understand your question.

14 Q Yeah, so if I say "in this proceeding," I
15 am referring to IPR 2025-00189 regarding the '666
16 patent; is that fair?

17 A Okay. The proceeding is the case number?

18 Q Yes.

19 A Okay. Sure.

20 Q Okay. I just wanted to make sure we have
21 that clear to clarify. Okay.

22 So Dr. Lee, if we could go to the last

1 page of Exhibit 1003.

2 A Yes.

3 Q You signed this declaration in
4 Exhibit 1003 on November 22nd, 2024, correct?

5 A Yes.

6 Q And moving forward, would it be okay if we
7 call this your original declaration?

8 A Sure.

9 Q Okay. And the reason I say that is you
10 submitted a second declaration in this case in
11 Exhibit 1027, correct?

12 A Yes.

13 Q And that second declaration is
14 Exhibit 1027?

15 A What you're showing on the screen right
16 now.

17 Q Okay. And so if you could pull up
18 Exhibit 1027 for a second.

19 A Yes, I have.

20 Q Exhibit 1027 is the declaration you
21 submitted in this proceeding on November 25th,
22 2025, correct?

1 A Yes.

2 Q Now, was your declaration in Exhibit 1027
3 intended to replace your declaration in
4 Exhibit 1003 or to add to it?

5 ATTORNEY HERMAN: Objection to form.

6 A I'm not sure what you mean by "replace" or
7 "add to it."

8 Q What was the purpose of the declaration
9 you submitted in Exhibit 1027?

10 A The purpose is -- of this, let's call this
11 reply declaration. Is that okay?

12 Q Yeah, let's use the term "reply
13 declaration" to refer to Exhibit 1027. Is that
14 okay?

15 A Sure. And then the 1003, let's call that
16 opening -- my opening declaration.

17 Q Okay. That's fair.

18 A Or you call that original declaration. So
19 let's say opening and reply declaration.

20 In my reply declaration, in paragraph 2,
21 essentially describes the purpose of my reply
22 declaration.

1 Q Is there anything that has come to your
2 attention that you would like to correct in your
3 declaration, Exhibit 1027?

4 A I don't recall any things that I want to
5 correct in my reply declaration. Let me --

6 Q When preparing your declaration --

7 A Hold on one second, sorry.

8 Okay. So in paragraph 87, I believe there
9 is a spelling error. The U.S. Patent Number
10 9,728,547 to Osaki, I believe it's missing a
11 letter H behind the letter O. Should have been
12 O-H-S-A-K-I.

13 If you look at paragraph 6, Exhibit 1029,
14 it's referring to the same U.S. patent '547, and
15 there, the inventor's name is spelled correctly.

16 Q Other than spelling errors, is there
17 anything that has come to your attention that you
18 would like to correct in your declaration,
19 Exhibit 1027?

20 A Not that I can think of at this point.
21 There might be some omitting error or grammatical
22 error, but as far as I can tell that -- other than

1 spelling and some formatting or grammatical error,
2 there -- I don't see any error in substance.

3 Q When preparing your declaration, were
4 there any materials you would like to have
5 reviewed but did not have access to?

6 A Not that I recall.

7 Q And have you submitted any errata sheets
8 for either your original or applied declarations?

9 A I don't recall exactly, and I have
10 submitted previously errata sheet on other patent,
11 but I don't recall exactly whether I have
12 submitted an errata sheet for this proceeding,
13 whether for the opening report -- or the
14 transcript for my opening declaration.

15 So I can't give you a definitive answer.

16 Q I'm not aware of any errata sheet, but
17 sitting here today, you're not aware of any errata
18 sheets for your original or reply declarations,
19 correct?

20 A Yes. My understanding -- you're the
21 lawyer -- is that for IPR, we don't submit errata
22 sheets anymore. Is that true?

1 Q I don't know. But you're not aware of
2 having done so yourself, correct?

3 A I know I have done for other IPR in the --
4 in this -- in the case of YMTC versus Micron case
5 which has many IPR, but I'm not aware for this
6 particular '666 IPR proceeding.

7 Q Let's go to exhibit -- let's go to your
8 reply declaration paragraph 2. Let me know when
9 you're there. I have it on the screen too.

10 A One second, please. Okay.

11 Q In your reply declaration, you respond to
12 proceedings offered by a Dr. Giapis, correct?

13 A Yes.

14 Q Apart from your work in this proceeding,
15 do you know Dr. Giapis?

16 A No.

17 Q And did you render any opinions on whether
18 Dr. Giapis qualifies as an expert in the subject
19 matter of the '666 patent?

20 A Regarding Dr. Giapis's qualifications?

21 Q Correct.

22 A No, I don't think so.

1 Q Do your opening and reply declarations
2 contain a complete and accurate statement of your
3 opinions regarding the validity of claim 19 of the
4 '666 patent?

5 ATTORNEY HERMAN: Objection. Form.

6 A Can you repeat the question and clarify
7 the question, please?

8 Q Are you offering any opinions regarding
9 the validity of claim 19 of the '666 patent that
10 are not found in your opening and reply
11 declarations?

12 ATTORNEY HERMAN: Objection. Form.

13 A My understanding is that this IPR
14 proceedings relate to claim 19, which depends on
15 claim 17. As I described earlier regarding what
16 the purpose is for my reply declarations, it is
17 summarized in paragraph 2 of my reply
18 declarations. And the purpose of my opening
19 declaration is described in paragraph 14.

20 So both, for example, in my opening
21 declaration in paragraph 14, said that I have been
22 asked to provide analysis and explain the subject

1 matter of the '666 patent. And at the end provide
2 my opinion, at the end of the paragraph, that --
3 the second sentence, that I've been also asked to
4 consider, analyze, and explain certain prior art
5 to the '666 patent, including how the art relates
6 to the challenged claims of the '666 patent and to
7 provide my opinions regarding whether that art
8 invalidates the claimed subject matter.

9 And since my -- since the only remaining
10 claims is claim 19, which depends on claim 17. So
11 both my reply declaration and my opening
12 declaration is how the prior art are used to
13 invalidate the claimed subject matters, namely
14 claim 19, which depends on claim 17.

15 Q And your opinions regarding the validity
16 of the claims in the '666 patent are found in your
17 original and reply declarations, correct?

18 ATTORNEY HERMAN: Objection. Form.

19 A Well, as I explain in paragraph 2 of my
20 reply declaration and paragraph 14 of my opening
21 declaration, that I'm asked to provide my opinions
22 regarding whether that the prior art to the '666

1 patent invalidates the claim subject matter. And
2 the opening report, opening declarations.

3 And the reply declaration contains my
4 opinion -- my opinions.

5 Q So your opinions in this proceeding are
6 found in your opening and reply declarations,
7 fair?

8 A I will also say that the transcript of my
9 deposition that you uploaded, I'll call that
10 Exhibit 10, I believe. The deposition of Jack
11 Lee, Ph.D., via videoconference, Thursday
12 October 10th -- October 30th, 2025, at 10:00 A.M.

13 So the testimony in my deposition also
14 contained and in support of my opening
15 declaration.

16 Q So your opinions in this proceeding are
17 found in your opening and reply declarations and
18 in your deposition transcripts; is that fair?

19 A I believe so.

20 Q And when was the last time you reviewed
21 your declaration, your reply declaration?

22 A This morning.

1 Q Have any of your opinions regarding the
2 validity of the '666 patent changed since you
3 submitted your reply declaration?

4 A I don't think so.

5 Q I want to refer you to paragraph 4 of your
6 reply declaration. Let me know when you're there.

7 A Okay.

8 Q Your reply declaration does not include a
9 legal standards section, correct?

10 A That's right. I refer to my opening
11 declaration.

12 Q So you applied the legal standards you
13 listed in your opening declaration, fair?

14 A That is correct.

15 Q Let's pull up your original declaration,
16 Exhibit 1003. Let me know when you have that up.

17 A Yes.

18 Q And we'll go to your legal standards
19 section.

20 Your legal standards section starts in
21 paragraph 18 of your original declaration,
22 correct?

1 A That is correct.

2 Q What were the legal standards you applied
3 when determining the meaning of the term "curved
4 side surface"?

5 A As described in paragraph 94 through 97,
6 that "I understand that during an IPR review, the
7 same construction standard used in the Federal
8 District Court is applied when addressing the
9 meaning of the claim terms."

10 In paragraph 95, "I have been informed
11 that the words of a claim are generally given
12 their plain and ordinary meaning," but I think I
13 need to read the entire section.

14 Do you want me to?

15 Q No, I don't think that's necessary.

16 What is your understanding of the role of
17 a patent specification in construing a patent
18 term?

19 A Can you clarify your question, please?

20 Q Yeah. What -- what don't you understand
21 about my question?

22 A Well, what do you mean by the role of the

1 specification? Because normally that -- I look at
2 to form my opinion regarding certain terms,
3 normally, I look -- not only that I look at the
4 specification but also the file history and more
5 importantly the claims itself and formulate my
6 opinion.

7 And once again, that is based on my
8 understanding of what it means by plain and
9 ordinary meaning.

10 Is there a question? Hello?

11 Q Yeah, no my -- I'm just looking for my
12 next question here.

13 In providing your opinions in your reply
14 declaration, what terms did you construe?

15 ATTORNEY HERMAN: Objection. Form.

16 A I don't know what you mean by what term
17 did I construe?

18 Q Maybe I can clarify, how about that?
19 Let's clarify.

20 Can you turn to paragraph 9 of your reply
21 declaration.

22 A Okay.

1 Q It's your opinion that the claim terms of
2 the '666 patent do not require further
3 construction, correct?

4 A "As I explained in my opening
5 declaration" -- and I repeated here in my reply
6 declaration -- "the '666 patent claim terms do not
7 require further construction and can instead be
8 afforded their plain and ordinary meaning."

9 And that's what it says in paragraph 9 of
10 my reply declaration.

11 Q What is your understanding of what a plain
12 and ordinary meaning is of a patent term?

13 ATTORNEY HERMAN: Objection. Form.

14 A Well, as I describe in my opening report
15 that the words of a claim are generally given
16 their plain and ordinary meaning, that the term or
17 phrase would have to POSITA at the time of
18 invention, in view of surrounding claim language,
19 the specification and file history. Collectively,
20 they're called intrinsic evidence or intrinsic
21 record.

22 And in the following two paragraph, I also

1 describe how it's extrinsic evidence, such as
2 expert and inventors' testimony, dictionary and
3 others, how that contributes to the understanding
4 of the claim terms. Although the so-called
5 extrinsic evidence are given or should be given
6 less weight than the intrinsic evidence.

7 And finally, in paragraph 97, that, again,
8 "the terms of the '666 patent claims do not
9 require further construction and can be afforded
10 their plain and ordinary meaning for the purpose
11 of the analysis of the prior art that I am
12 conducting in this declaration," meaning in this
13 opening declaration, and I applied the same to my
14 reply declaration.

15 ATTORNEY WATSON: I think we've been going
16 about an hour and 15 minutes. How about we take a
17 five-, ten-minute break.

18 THE WITNESS: Sounds good.

19 ATTORNEY WATSON: Let's go off the record.

20 (Recess.)

21 BY ATTORNEY WATSON:

22 Q Dr. Lee, can you turn to paragraph 10 of

1 your reply declaration, and I'll put it on the
2 screen too so we can be in the same place.

3 Dr. Lee, do you see -- Dr. Lee, do you
4 have paragraph 10 in front of you?

5 A Yes.

6 Q Is it your opinion that the term "side
7 surface," in the '666 patent, would be understood
8 to be any of the bounding surfaces of a
9 three-dimensional structure?

10 A That's what it says in paragraph 10.

11 Q Is that your opinion?

12 A Well, paragraph 10 is in my reply opinion,
13 and my reply opinion contains my opinions. So the
14 answer is yes. And obviously, that is not -- you
15 know, I also explain more in the subsequent
16 paragraphs and also in my opening report regarding
17 how a person of ordinary skill in the art, in
18 understanding the term.

19 Q So what is your understanding of the plain
20 and ordinary meaning of "side surface" in view of
21 the '666 patent's intrinsic record?

22 A Well, my understanding of the term "side

1 surface" has been explained in my reply
2 declaration, particularly in paragraph 10 to
3 paragraph 36. And I'm sure you don't want me to
4 read the entire sections in those paragraphs, but
5 that basically described how I understand the term
6 "side surface" and how the patent owner and
7 Dr. Giapis is wrong in their narrow
8 interpretations of the term "side surface."

9 Q So in paragraph 10, you opine that the
10 term "side surface" refers to any of the bounding
11 surfaces of a three-dimensional structure, fair?

12 A Again, that's just, you know, the overview
13 of my -- not just my understanding, but a person
14 of ordinary skill in the art reading the '666
15 patent and the claims would understand that,
16 again, that there are more details in the
17 subsequent paragraphs.

18 Q Okay. But I'm just trying to understand,
19 what -- how are you construing the term "side
20 surface" in view of the '666 patent?

21 ATTORNEY HERMAN: Objection. Form.

22 A I'm not construing the term "side

1 surface," but I'm saying that how a person of
2 ordinary skill in the art would have understood
3 the term "side surface" and how that is readily
4 understandable. And that's what I said in
5 paragraph 10, and again, I provide more evidence
6 to support that understanding in the subsequent
7 paragraph, paragraphs that I mentioned.

8 In fact, the -- The entire reply
9 declarations -- reply declaration and the opening
10 declarations, I spend a lot of time in how a
11 person of ordinary skill in the art would
12 understand the term "side surface."

13 Q Let's turn to paragraph 12 of your reply
14 declaration.

15 What are you showing in the figure of
16 paragraph 12 of your reply declaration?

17 A I'm showing the -- an example of
18 three-dimensional shape as shown in paragraph --
19 at the bottom of page 5. It shows that it has a
20 total of ten side surfaces; the top, the bottom,
21 four lateral surfaces, four surfaces, bounding the
22 hole through the inner -- through the shape's

1 middle.

2 Q So this figure in paragraph 12 -- strike
3 that.

4 In this figure in paragraph 12, you
5 labeled each surface of an example
6 three-dimensional shape, correct?

7 A I labeled the ten side surfaces.

8 Q And one of those surfaces is what you call
9 a top, correct?

10 A Yes.

11 Q In your figure in paragraph 12, which
12 surface is a top surface?

13 A I believe it's labeled number 5.

14 Q The top surface in this figure in
15 paragraph 12 is a horizontal surface. Is that
16 fair?

17 A Well, I didn't label any axis for this
18 particular three-dimensional shape, and the
19 orientations of that three-dimensional shape. So
20 I suppose you can't really say which one is
21 horizontal and which one is vertical unless that
22 shape has been labeled, which of the planes are

1 horizontal, which of the planes are vertical. But
2 if you orient it, let's say we label X, Y, Z-axis
3 and the top surface, 5, is parallel to the X-Y
4 surface -- do you understand what I'm saying?

5 And if that is what is labeled a
6 horizontal, then -- so we get -- then the top
7 surface would be -- might be understood as the
8 top -- may be understood as the top surface
9 oriented in a horizontal direction.

10 But, you know, it's not -- just looking at
11 the figures in paragraph 12 without more details
12 of labeling the axis and defining the horizontal
13 and level and vertical, I suppose you can't really
14 say directly.

15 Q One surface in this figure in paragraph 12
16 is what you call a bottom surface, correct?

17 A Yes.

18 Q In your figure in paragraph 12, which
19 surface is a bottom surface?

20 A I believe it's labeled number 6.

21 Q And the bottom surface is parallel to the
22 top surface, fair?

1 A The way it is drawn, yes.

2 Q You also identified four surfaces as
3 lateral surfaces, correct?

4 A Yes.

5 Q What's a lateral surface?

6 A Well, in the -- in the drawing, it's
7 labeled 1, 2, 3, 4. So lateral surface in plain
8 and ordinary meaning would mean that it's a
9 side-facing surfaces as opposed to top-facing or
10 bottom-facing surfaces.

11 And so my understanding is lateral means
12 sideways, perhaps. And lateral surface would mean
13 that a surface facing sideways, not up or down.
14 So that's my understanding.

15 Now, of course, in general, in plain and
16 ordinary meaning, in an English dictionary, I
17 think that's what it means. Obviously in a
18 certain context, it might mean differently, but I
19 think in general the lateral surfaces basically is
20 a surface that faces -- that face sideways, not up
21 or down.

22 Q So the lateral surface faces the side

1 rather than facing the top or the bottom, right?

2 ATTORNEY HERMAN: Objection to form.

3 A That's what I explained just now.

4 Q You also identify four surfaces bounding
5 the hole through the shape's middle, correct?

6 A Yes.

7 Q What are those four surfaces?

8 A Those are 7, 8, 9, and 10 in the figure at
9 the bottom of page 5 in paragraph 12.

10 Q And those four surfaces are shown in your
11 figure to be parallel to the four lateral
12 surfaces; is that fair?

13 A You can say that, yes.

14 Q And the four lateral surfaces and the four
15 surfaces bounding the hole through the shape's
16 middle are perpendicular to the top and bottom
17 surfaces, fair?

18 A Yes, that the -- the way it is drawn is
19 that the four lateral surfaces and the four
20 interior wall of the four holes or what I wrote,
21 the four surfaces bounding the hole through the
22 shape's middle are perpendicular to the top and

1 bottom surfaces.

2 Q And so there's ten surfaces shown in
3 paragraph 12 of your report; is that right?

4 A That's what I said in paragraph 12.

5 Q Now let's pull up Figure 7 of the '666
6 patent. I'll put it on the screen, but you can
7 have your local copy if you need it.

8 A Yes.

9 Q Let me know when you're there.

10 A Are you talking about Figure 6 or
11 Figure 7?

12 Q Figure 7.

13 A I'm sorry. Again, I thought earlier you
14 said Figure 6.

15 Q Are you at Figure 6? I'm sorry, now you
16 got me confused. Are you at Figure 7?

17 A Yes.

18 Q In Figure 7 of '666 patent, what is
19 labeled as 720 is the landing pad, correct?

20 A In -- in column 9, line 7 -- line 8
21 through 10, it says, "Figure 7 illustrates the
22 cross-section view of a staircase structure 700

1 with landing pads 720, according to some
2 embodiments."

3 Q Okay. So you understand that, in
4 Figure 7, what's labeled as 720 is the landing
5 pad, correct?

6 A That's what I just read.

7 Q Now, under your construction of side
8 surface, how many side surfaces does landing pad
9 720 have in Figure 7?

10 A Again, you keep saying "construction." I
11 did not construe any terms.

12 Q Okay. Under the meaning of "side surface"
13 that you applied in reaching your opinions, how
14 many side surfaces does landing pad 720 have in
15 Figure 7?

16 ATTORNEY HERMAN: Objection. Form.

17 A So your question is how many side surfaces
18 in the landing pad of 720 of Figure 7. Am I
19 understanding correctly?

20 Q How many side surfaces does the landing
21 pad in Figure 720 have? Correct.

22 A Well, first of all -- first of all, a

1 person of ordinary skill would understand that a
2 staircase structure is a three-dimensional
3 structure, and what is shown in Figure 7 is only a
4 cross-section of its three-dimensional structure.

5 So one of ordinary skill in the art by
6 just looking at 720, the landing pad's number 720
7 shown in the cross-section of the Figure 7 would
8 not definitively be able to identify all the side
9 surfaces, because this is only showing a
10 cross-section of a three -- three-dimensional
11 device.

12 Q Would a person of ordinary skill in the
13 art know there's more than four side surfaces in
14 the landing pad in Figure 7, 720?

15 A I'm saying that from the figure itself,
16 one cannot identify all the side surfaces.

17 Q And my question was, would a person of
18 ordinary skill in the art know if there were more
19 than four side surfaces in the landing pad 720 in
20 Figure 7.

21 A Well, first of all, the figure that you've
22 shown in this Figure 7 are in such poor

1 resolution. And each one of those 720s, landing
2 pads, are drawn differently, total of six landing
3 pads. You can see that the top landing pads are
4 very different from the other five. And each of
5 the five patents are also drawn differently.

6 So -- and again, this is a cross-section
7 of a three-dimensional device. So one would not
8 definitively identify all the side surfaces,
9 unless it's assuming a certain parameters of the
10 surfaces into the -- into the board, in other
11 words, in the x/y-axis.

12 (Reporter clarification.)

13 A Into the board, into the paper. In other
14 words, along the x/y-axis, along the x-y plane.

15 ATTORNEY WATSON: Okay. I'm going to move
16 to strike that as nonresponsive. Let me try this
17 question again.

18 ATTORNEY HERMAN: Objection to form.
19 Also, that's not a relief that's available to you.

20 ATTORNEY WATSON: I'm pretty sure you guys
21 have done it multiple times in multiple
22 depositions.

1 ATTORNEY HERMAN: I have not done anything
2 of any sort in --

3 ATTORNEY WATSON: I'm not saying you,
4 Patrick, but you certainly have -- your team has
5 certainly done it in multiple depositions I've
6 been in, so...

7 Q Let me try this -- let me try a different
8 question.

9 So Dr. Lee, in Figure 7 of the '666
10 patent, the landing pad would be understood to be
11 a three-dimensional object, correct?

12 A That's what I have said. A 3D NAND is a
13 three-dimensional structure, and a landing pad is
14 a three-dimensional structure. What is shown in
15 Figure 7 is only a cross-section.

16 Q So a person of ordinary skill in the art
17 would understand there is, at minimum, a top
18 surface of the landing pad 720, correct?

19 A You can say that, yes.

20 Q And a person of ordinary skill in the art
21 would understand there's, at minimum, a bottom
22 surface of the landing pad 720, correct?

1 A Yes.

2 Q And a person of ordinary skill in the art
3 would understand there's, at minimum, four lateral
4 surfaces of the landing pad 720, correct?

5 A That's right.

6 Q So a person of ordinary skill in the art
7 would understand there is at least six surfaces of
8 landing pad 720 in Figure 7, correct?

9 A A person of ordinary skill in the art --
10 for example, if you look at the -- the very top
11 landing pad is 720. Okay? Which show the
12 cross-section as a rectangle. And if one
13 extrapolates what they look like in the x/y-axis,
14 one would understand that there is a top surface
15 parallel to the x/y-axis, a bottom surface -- I'm
16 sorry, let me rephrase that.

17 A A top side surface parallel to the
18 x/y-axis, a bottom side surface parallel to the
19 x/y-axis, four lateral side surfaces perpendicular
20 to the x/y-axis. So that will be total of six
21 side surfaces in the top landing pad 720. If the
22 understanding of -- of what it appears to be --

1 can be extrapolated into the x-y plane.

2 Q And in Figure 7, there's a substrate, I
3 believe it's 204, correct?

4 A I beg your pardon?

5 Q In Figure 7, what's marked as 204 is a
6 substrate, correct?

7 A Can you --

8 Q I'm sorry, let me -- let me strike that
9 and repeat the -- give you a slightly different
10 question.

11 The '666 patent describes a substrate,
12 correct?

13 A Yes.

14 Q And that substrate has a top surface,
15 correct?

16 A Yes.

17 Q And that -- the top surface of the
18 substrate is shown to be in the X-Y direction,
19 fair?

20 ATTORNEY HERMAN: Objection. Form.

21 A Can you repeat that question again? I'm
22 sorry.

1 Q The top surface of the substrate is in the
2 X-Y direction, in the x-y plane, correct?

3 A So the only place it identifies the
4 substrate is in Figure 1. It identifies it as the
5 layer 101. Okay? And so -- and as you can see
6 that in layer 101, again, Figure 1 again only
7 shows the cross-section and the substrate is
8 showing as a rectangle, so a person of ordinary
9 skill in the art would -- would have understood
10 that the substrate, based on this drawing, and
11 assuming that it extend into the X-Y direction,
12 would have six side surfaces, two top side
13 surfaces -- one top side surface, one bottom side
14 surface, and four lateral side surfaces.

15 Q Now, I want to go to --

16 A And the top -- the top side surface would
17 be parallel to the x/y-axis.

18 Q So the top and bottom surfaces are
19 parallel to the X/y-axis, fair?

20 A In Figure 1, the substrate 101 has both a
21 top side surface and a bottom side surface, and
22 both of which are parallel to the x/y-axis,

1 assuming that the three-dimensional perspective is
2 extended into the board with -- with some
3 expectations. But since it didn't show a true
4 three-dimensional structure, the top side surface
5 might be tilted. We don't know. Okay. But
6 assuming that it doesn't happen that way, then a
7 person of ordinary skill in the art might have
8 understood that the top side surface and the
9 bottom side surface are parallel to the x/y-axis.

10 Q Let's go to paragraph -- let's go to
11 column 5, lines 3 through 5 of the '666 patent.

12 A Column 5?

13 Q Mm-hmm.

14 A Right?

15 Q Correct.

16 In the '666 patent, "the terms
17 'horizontal/horizontally/lateral/laterally' mean
18 nominally parallel to a lateral surface of a
19 substrate," correct?

20 A That's what it says there.

21 Q So in the '666 patent, horizontal and
22 lateral both mean the same thing, correct?

1 ATTORNEY HERMAN: Objection. Form.

2 A What do you mean by "both mean the same
3 thing"?

4 Q Well, the '666 patent defines horizontal
5 and lateral as "nominally parallel to a lateral
6 surface of a substrate," correct?

7 A So it seems to me a person of ordinary
8 skill in the art reading this sentence would mean
9 that -- would understood as, if the surface
10 direction or movement runs along the plane of the
11 wafer, it might be considered as horizontal or
12 narrow.

13 When they say "nominally," it means that,
14 in my mind, I believe a person of ordinary skill
15 in the art would understand that it means
16 approximately, generally, or for practical
17 purpose. I don't know. You might be able to tell
18 me in terms of legal sense what "nominally" means.

19 So it seems to me that it doesn't mean
20 that those surfaces are perfectly parallel, just
21 approximately parallel, with some angle, small
22 angle or irregularities. I don't know.

1 You might be able to explain in the legal
2 sense what it means by "nominally" better than I
3 can obviously.

4 Q So the reason I bring this up is in
5 paragraph 12 of your report, you refer to four
6 lateral surfaces, right?

7 A Sorry, in my reply declaration?

8 Q Correct. In your reply declaration,
9 paragraph 12, you talk about four lateral
10 surfaces.

11 A Yes.

12 Q Okay. But the meaning of "lateral" that
13 you used in paragraph 12 is different than the
14 meaning that the '666 patent applies to the
15 meaning of the word "lateral," correct?

16 ATTORNEY HERMAN: Objection. Form.

17 A I think that what I said in figure -- in
18 paragraph 12, I'm talking about the lateral
19 surface. Meaning that it's a sidewall. And as
20 shown in the figure, in paragraph 12, that like
21 many sidewall happen to be vertical.

22 And on the other hand, I believe that the

1 column 5, line 3 to 5 in the '666 patent that you
2 mentioned, in the -- in the context of
3 semiconductor engineering, the lateral direction
4 are parallel to the substrate.

5 So I think the confusion that you have, I
6 believe is referring to the lateral -- the word
7 "lateral" can be used to refer to a direction or
8 the surfaces. So I believe that there is nothing
9 wrong with my statement in my reply declaration in
10 paragraph 12. I don't think it's contradictory to
11 what is read in column 5, line 3 to 5 of the '666
12 patent.

13 Q And the reason you believe it doesn't
14 contradict is, in paragraph 12, you're using the
15 word "lateral" to refer to a particular surface
16 wall in the '666 patent, the word "lateral" is
17 being used to refer to a direction; is that fair?

18 A Yeah, in -- in paragraph 12, I use the
19 word "lateral" referring to a side surface -- a
20 lateral side surface when it means a sidewall.
21 And everybody knows what a sidewall is. And many
22 sidewall happens to be vertical. And -- and

1 there -- in paragraph -- the second paragraph in
2 column 5, they're referring to a direction. I
3 believe that's the key differences.

4 Q Okay. So your use of "lateral" in
5 paragraph 12 is not the same usage of "lateral"
6 that they're talking about in that -- in column 5,
7 lines 3 through 5, fair?

8 A The --

9 ATTORNEY HERMAN: Objection to form.

10 (Reporter clarification.)

11 THE WITNESS: I'm sorry, Patrick.

12 A Do you want me to repeat my explanation?

13 Q Let me re-ask the question. That got a
14 little muddled, and I'm sure Patrick will offer
15 the same objection.

16 Your use of "lateral" in paragraph 12 is
17 not the same use of "lateral" that they're talking
18 about in column 5, lines 3 through 5 of the '666
19 patent?

20 ATTORNEY HERMAN: Same objection.

21 A As I mentioned and explained earlier, in
22 column -- in Figure 12 -- sorry, in figure -- in

1 paragraph 12, when I say "lateral surface" or
2 "lateral surfaces," I'm referring to lateral side
3 surface of a structure, perhaps commonly known as
4 sidewalls. And many sidewall happen to be
5 vertical.

6 In column 5, line 3 to 5, I believe when
7 they say horizontal, horizontally, lateral,
8 laterally, they're referring to a direction which
9 says it's nominally parallel to a lateral surface
10 of a substrate, meaning that -- yeah.

11 So I think -- I believe the difference is
12 one is talking about sidewall, one is talking
13 about direction. That's my understanding.

14 Q Okay. In the '666 patent, column 5, lines
15 11 through 12, the '666 patent defines the term
16 "vertical/vertically" to mean "nominally
17 perpendicular to lateral surface of a substrate,"
18 correct?

19 A Where are you?

20 Q Column 5, lines 11 through 12.

21 A That's what it says, "The term
22 'vertical/vertically' means nominally

1 perpendicular to the lateral surfaces" -- or
2 "lateral surface of the substrate."

3 Q So something that's vertical would be
4 nominally perpendicular to the lateral -- or
5 horizontal surface of the substrate. Is that
6 fair?

7 A Yeah, I mean, it's simple geometry, right?
8 Vertical is perpendicular to horizontal.

9 Q So let's go back to Figure 7 of the '666
10 patent.

11 Do you have that in front of you?

12 A Yes.

13 Q In Figure 7, the top and bottom surfaces
14 of the landing pad would be horizontal surfaces,
15 fair?

16 A Yeah. One of ordinary skill in the art,
17 looking at the cross-section of Figure 7 -- again,
18 this is only a two-dimensional illustration of a
19 three-dimensional structure. So one, if you make
20 some assumption whether it extends, how it extends
21 into the x/y-axis, into the x-y plane. But
22 assuming that it's extended into the x-y plane in

1 a parallel fashion, then yeah, you would -- each
2 one of the 720 landing pad would have a top side
3 surface and a bottom side surface.

4 Q And in addition to these top and bottom
5 surfaces, there would be at least four vertical
6 surfaces of the landing pad 720, correct?

7 A Yes. In the -- for example, with the top
8 landing pad in Figure 7, it just say rectangle in
9 a cross-section. It would have a top side surface
10 and a bottom side surface and four, what I call
11 lateral surfaces or the sidewalls. So I would say
12 four horizontal side surfaces.

13 Q There would be four horizontal side
14 surfaces and two vertical side surfaces; is
15 that --

16 A I'm saying the two horizontal side
17 surfaces and four vertical side surfaces.

18 Q So in Figure 7 of the '666 patent, landing
19 pad 720 has at least two horizontal side surfaces
20 and four vertical surfaces?

21 A You would have at least one horizontal top
22 side surface, one horizontal bottom side surface,

1 and four vertical side surfaces.

2 Q Okay. Let's go back to your reply
3 declaration. Let's go to paragraph 13.

4 A Just one second, please.

5 Okay.

6 Q In paragraph 13, you provide a dictionary
7 definition of "side," which is, "any outer surface
8 of the object," correct?

9 A Yes. It says that "A POSITA would have
10 understood a 'side' (and relatedly a 'side
11 surface') when referring to a three-dimensional
12 object to refer to any 'outer surface of [the]
13 object.'" And I cite Exhibit 1024 at 483.

14 Q How is this dictionary definition of
15 "side" related to what a side surface is?

16 A So your question is, how does this opinion
17 relate to what?

18 Q I think my question is a little simpler
19 than that. So you say, "relatedly a 'side
20 surface.'"

21 Do you see that?

22 A Yes.

1 Q How does the definition of "side" that you
2 cite here relate to the definition of "a side
3 surface"?

4 A I'm not sure I understand your question.

5 Q Okay. Let me try a different question.

6 Would you agree with me that a side
7 surface would be any outer surface of an object?

8 A That is what the dictionary says, that the
9 side surface -- that "A person of ordinary skill
10 in the art would have understood the term 'side'
11 (relatedly a 'side surface') when referring to a
12 three-dimensional object to refer to any 'outer
13 surface of [the] object.'"

14 So -- so my understanding is that the term
15 "side" is a portion of a three-dimensional object;
16 whereas "side surface," perhaps it's the actual
17 surface area that formed the side. Does that make
18 sense? In other words, the side surface is a
19 physical surface that makes up a side.

20 Q Okay.

21 A So when he says that -- when the
22 dictionary defined "side" as "any outer surface of

1 an object," I believe a person of ordinary skill
2 in the art would understand that the surface
3 corresponding to that side is a side surface.

4 Q Okay. So a side surface would refer to
5 the outer surface of a three-dimensional object?

6 A I believe that a side surface is simply
7 the surface corresponding to a side of a
8 three-dimensional object. Okay? A POSITA would
9 have understood that side surface to encompass any
10 such bounding surface.

11 Q What do you mean by "bounding surface"?

12 A Well, let me perhaps -- "bounding" means
13 by forming a boundary perhaps. Maybe I should
14 rephrase that.

15 Forming the outer surface of the object.
16 Okay, I don't want to introduce another term. I'm
17 sorry.

18 Q Okay. So a person of ordinary skill in
19 the art would have understood that a side surface
20 encompasses any outer surface of an object?

21 ATTORNEY HERMAN: Objection. Form.

22 A Well, I believe that what I've written in

1 paragraph 13 that would have -- you know, from the
2 dictionary, a person of ordinary skill in the art
3 would understand that "side surface" is referring
4 to a three-dimensional subject -- object, to refer
5 to any outer surface of the object.

6 Q Let's go to paragraph 15 of your reply
7 declaration. Let me know when you're there.

8 A Okay.

9 Q In paragraph 15, you discuss the term "a
10 curved side surface."

11 Do you see that?

12 A Yes.

13 Q What is the plain and ordinary meaning of
14 "a curved side surface" that you applied in
15 reaching your opinions?

16 A So in my reply declaration and my opening
17 declaration, "curved side surface" is given a
18 plain and ordinary meaning and not a process
19 oriental -- orientation-based meanings.

20 So what I was trying to find is that, in
21 my opening declaration in paragraph 202, said that
22 "In my opinion, a person of ordinary skill in the

1 art would have understood that this teaches a
2 variety of different protrusions of pad" -- you
3 know, they're referring to the landing pad, many
4 of which have the type of so-called curved side
5 surface that claim 17 requires.

6 So "This includes, for instance, pads with
7 curved sides when viewed in cross-section or pads
8 with curved sides when viewed above."

9 So in other words, in plain and ordinary
10 meaning, a curved side surface is a side surface
11 that is not planar. Instead have a curvature,
12 have a radius. In paragraph 202 of my opening
13 declaration, have a curve size.

14 It doesn't have to be vertical, it doesn't
15 have to be curved along the Z-axis. It doesn't
16 have to be -- result from poor step coverage. And
17 this is apparatus claim. It does not depend on
18 how it was fabricated.

19 So a person of ordinary skill in the art,
20 in summary, would understand that the meaning of
21 "curved side surface" to be any non-flat side
22 surface of the conductive pad layer, in

1 understanding of claim 17.

2 Does that make sense to you?

3 Q Sure. So let's go to paragraph 8 -- 18 of
4 your declaration.

5 A 18?

6 Q Mm-hmm.

7 A Okay.

8 Q In paragraph 18, you state, "The applicant
9 plainly could have claimed a 'side surface' that
10 is oriented in a particular way relative to the
11 'top surface' (i.e., the claim could have
12 specified that the 'side surface' is
13 'perpendicular' to the 'top surface' of the
14 substrate)."

15 Do you see that?

16 A Yes.

17 Q And let's look at claim 1 of the '666
18 patent.

19 Do you have that in front of you?

20 A Yes.

21 Q In claim 1, the landing pad includes a top
22 surface and a side surface, correct?

1 A Yes.

2 Q By separately claiming both a top surface
3 and a side surface, does the side surface still
4 encompass a top surface?

5 ATTORNEY HERMAN: Objection. Form.

6 A Can you repeat the question, please?

7 Q By separately claiming both a top surface
8 and a side surface, does the side surface still
9 encompass a top surface?

10 ATTORNEY HERMAN: Objection. Form.

11 A A person of ordinary skill in the art
12 would understand that side surface does not have
13 any particular orientation, a particular surface.
14 A side surface could be a bottom side surface, a
15 top side surface, and so on and so forth.

16 So the answer is -- is that yes, bottom
17 side surface, top side surface, first side
18 surface, second side surface, claim 1 and 2
19 specify the landing pad of these claims. However,
20 claim 17, the inventor chose not to -- not to
21 claim any particular surface.

22 Q Let's turn to paragraph 19 of your reply

1 declaration.

2 A That's where I was.

3 Q Oh, okay. All right.

4 Does the fact that claims 1 and 2 refer to
5 a landing pad with a top, bottom, and side surface
6 have any impact on how you understand the term
7 "side surface"?

8 ATTORNEY HERMAN: Objection. Form.

9 A It's described in paragraph 19, claim 1
10 and 2 use specific terms such as bottom surface
11 and the top side surface -- side -- bottom surface
12 and top side surface, and the applicants could
13 have claimed a particular surface in claim 19 but
14 deliberately not -- chose not to.

15 So what it means is that the term "side
16 surface" must include not only lateral surfaces
17 but also the top and bottom surfaces of a layer.

18 Q You say in paragraph 19 that claim 1's
19 reference to a landing pad with a top, bottom, and
20 side surfaces "merely shows that the applicant
21 knew how to craft a claim that excludes the top
22 and bottom surfaces of a layer from the scope of

1 the term 'side surface,'" correct?

2 A No, I didn't say that. I said it -- "it
3 once again merely shows that the applicant know
4 how to" -- "knew how to craft a claim that
5 excludes the top and bottom surfaces of a layer
6 from the scope of the term 'side surface,'" right?

7 And this is accomplished by specifying
8 that the layer has the top, bottom, and side in
9 the same claim. Again, the applicant chose not to
10 do so in claim 17 --

11 Q So is your opinion --

12 Go ahead and finish if you hadn't.

13 A -- when -- when referencing only a side
14 surface.

15 Q So is it your opinion that claims 1 and
16 2's usage of the terms "bottom surface" show that
17 the applicant knew how to craft a claim that
18 excludes the top and bottom surfaces of a layer
19 from the scope of the term "side surface"?

20 A Can you repeat that?

21 ATTORNEY HERMAN: Objection to form.

22 Q Sure.

1 A I think there's something wrong with your
2 question because you said -- go ahead. Repeat
3 your question, please.

4 Q Is it your opinion that claim 1 and 2's
5 usage of the terms "top and bottom surface" show
6 the applicant knew how to craft a claim that
7 excludes the top and bottom surfaces of a layer
8 from the scope of the term "side surface"?

9 ATTORNEY HERMAN: Objection to form.

10 A Yes, that's what I said right there, "that
11 the applicant knew how to craft a claim that
12 excludes the top and bottom surface" -- "surfaces
13 of a layer from the scope of the term 'side
14 surface.'"

15 And -- and, again, this is accomplished by
16 specifying the layer has a top, bottom, and side
17 in the same claim, but claim 17, the applicant
18 chose not to do so.

19 Q So it's your opinion that the meaning of
20 "side surface" in claim 1 and 2 excludes the top
21 and bottom surface, correct?

22 ATTORNEY HERMAN: Objection. Form.

1 A Again, that the applicants knew how to
2 craft a claim that excludes the top and bottom
3 surfaces of a layer from the scope of the term
4 "side surface." So it didn't do that in claim 17,
5 so therefore, the term "side surface" in claim 17
6 must include not only the lateral surfaces but
7 also the top and bottom surfaces of a layer.

8 Q I don't think that was quite my question.
9 I'm referring to claims 1 and 2, correct?
10 Are we on the same page here?

11 A Yes, I --

12 Q Claim 17? Okay.

13 A I just answered you, that claim 1 and 2
14 basically indicating that it excluded the top and
15 bottom surfaces of a layer from the scope of the
16 term "side surface."

17 Q Okay. So claims 1 and 2 exclude top and
18 bottom surfaces from the scope of the term "side
19 surface," correct?

20 A In the limitations of claim 1 and 2 --
21 claim 17, an inventor did not do so. So
22 therefore, a person of ordinary skill in the art

1 reading claim 17 would understand the term "side
2 surface" must include not only the lateral
3 surfaces but also include the top and bottom
4 surfaces of a layer.

5 Q So the side surface term in claims 1 and 2
6 has a different meaning than the side surface in
7 claim 17, correct?

8 ATTORNEY HERMAN: Objection. Form. It
9 mischaracterizes the witness's testimony.

10 A I'm saying that in claim -- claim 1 and 2,
11 it used specific terms, the bottom surface and a
12 top surface, that -- specifying the landing pad of
13 those claims and those claims only, that exclude
14 the top and bottom surfaces of a layer from the
15 scope of the term "side surface" in -- only in
16 claim 1 and 2.

17 In claim 17, which is independent, it
18 doesn't say that. So therefore, it follows that
19 the term "side surface" must include not only the
20 lateral surfaces but also the top and bottom
21 surfaces of a layer in claim 17.

22 Q So by claims 1 and 2 claiming a top and

1 bottom surface, the term "side surface" in claim 1
2 and 2 excludes top and bottom surfaces, fair?

3 ATTORNEY HERMAN: Objection. Form. Also,
4 once again, mischaracterizes the witness's
5 testimony.

6 A I said that the applicants knew how to
7 craft a claim that exclude the top and bottom
8 surfaces of a layer from the scope of the term
9 "side surface," in claim 1 and 2, but not in claim
10 17. Okay? That exclusion only applied to claim 1
11 and 2. But the applicant deliberately chose not
12 to do so in claim 17.

13 Q So in claim 1 and 2, the term "side
14 surface" does not encompass top and bottom
15 surfaces, correct?

16 ATTORNEY HERMAN: Objection. Form.

17 A In claim 1 and 2, the applicants wrote it
18 in such a way that the claim exclude the top and
19 bottom surfaces of a layer from the scope of the
20 term "side surface." But in claim 17, it does not
21 do so and deliberately not -- not do --
22 deliberately chose not to do so.

1 It is not any new opinion. I say that
2 same thing in my original opening declaration.

3 So I do not understand why we keep hashing
4 out this point that we -- we talk about it many
5 times in my deposition that lasted seven hours
6 back in the -- related to the opening declaration.

7 Q I just am asking a simple question.

8 A I answered you --

9 Q -- let me finish it --

10 A I'm sorry.

11 Q I mean, I'm entitled to ask my questions.

12 And let me ask my questions and I'll give you a
13 chance to answer, if that's okay, Dr. Lee. So let
14 me try a different question for you.

15 The scope of -- strike that.

16 The term "side surface" in claims 1 and 2
17 encompasses a different scope than the term "side
18 surface" in claim 17?

19 ATTORNEY HERMAN: Objection. Form.

20 A I don't know what you mean by that, but I
21 answered it many times now. In 1 and 2, the claim
22 is drafted in such a way that it excludes the top

1 and bottom surfaces of a layer from the scope of
2 the term "side surface." And the inventor, the
3 applicant chose not to do so in claim 17, and
4 therefore, a person of ordinary skill in the art
5 reading claim 17 would understand that the term
6 "side surface" must include not only the lateral
7 surfaces but also the top and bottom surfaces of a
8 layer.

9 ATTORNEY WATSON: All right. Let's take a
10 break. We've been going about an hour and a half.

11 (Luncheon recess.)

12 BY ATTORNEY WATSON:

13 Q Dr. Lee, can I refer you to column 4,
14 lines 10 through 20 of the '666 patent. Put it on
15 the screen as well.

16 A Hold on one second.

17 Column 4?

18 Q Yes.

19 A What lines?

20 Q Lines 10 through 20.

21 A Hold on one second.

22 Q Are you there?

1 A I'm sorry. So this is starting --

2 Q With "Further, spatially relative terms."

3 Do you see that paragraph?

4 A Yes.

5 Q The '666 patent uses "spatially relative
6 terms to describe one element or feature's
7 relationship to another element or feature as
8 illustrated in the figures," correct?

9 A That's what it says there.

10 Q So the '666 patent -- strike that.

11 Does that mean the '666 patent teaches
12 that spatially relative terms describe the
13 features' orientations relative to each other as
14 illustrated in the figures?

15 ATTORNEY HERMAN: Form.

16 A I think this is basically a clarification,
17 right? They use the word such as "above,"
18 "below," "upper," and "lower" simply to make the
19 description easier to follow, right, based on how
20 the device is drawn in the figure, but those words
21 do not lock the invention to any one orientation,
22 physical orientation.

1 What was your question? I'm sorry.

2 Q Would you agree with me that the spatially
3 relative terms used in the '666 patent describe
4 how different features are oriented relative --
5 relative to each other?

6 A Well, is your question specifically
7 related to what we just quote in column 4?

8 Q For the entire '666 --

9 A For the entire '666 patent.

10 So this paragraph that you just read
11 describe how the '666 patent distinguish above --
12 terms like "above" and "below," but it is used
13 only for descriptive convenience and do not limit
14 the invention to any particular physical
15 orientation or the orientation shown in the
16 figures.

17 And if you read the paragraph above that
18 or -- I mean, what it's saying is that the
19 invention is not orientation-dependent. The
20 device can be rotated, right, 90 degrees upside
21 down, and in any other -- in other orientation.
22 The relationships still apply between parts.

1 So in other words, the word -- the
2 wordings or the words should be interpreted
3 flexibly, that the device -- if the device is
4 rotated above my -- then become beside or below in
5 a physical space, and the terminology would adapt
6 to the orientation. That's my understanding.

7 But what it doesn't require -- what it
8 doesn't do is it does not require vertical or
9 horizontal orientation, and doesn't limit the
10 claims to be Z-axis, and doesn't tie the claim,
11 scope to how a figure is drawn or how a figure is
12 drawn and does not redefine what side surface
13 occurred.

14 So I think we addressed this in the last
15 deposition also. This is not a new opinion. This
16 is the same old thing.

17 Q I simply was asking whether the '666
18 patent uses these relative terms to describe how
19 features are positioned relative to each other as
20 opposed to any singular orientation.

21 A Right, and I answered that.

22 Q Let's go to paragraph 20 of your reply

1 declaration. Let me know when you're there.

2 A Is that, "The specification of the '666
3 also patent does not require any" --

4 Q It starts with that, correct.

5 A Okay.

6 Q I want to direct your attention down to
7 the last sentence. You state, "A POSITA would
8 also recognize that even though the figures depict
9 vertically oriented surfaces, those drawings are
10 merely illustrative examples."

11 Do you see that sentence?

12 A Yes.

13 Q So you'd agree with me that the figures in
14 the '666 patent depict side surfaces that are
15 vertical, correct?

16 ATTORNEY HERMAN: Objection. Form.

17 A You were saying that whether the figures
18 are drawn vertical sidewalls?

19 Q Correct.

20 A Or vertical side surfaces, right?

21 Q Correct.

22 A So first of all, as I mentioned before and

1 many times last time and this time, the side
2 surface means any surface, right? And even though
3 the patent -- some patent drawing can be
4 interpreted that, as shown a vertical sidewall,
5 those drawings are just example and how the
6 invention might look like, a person of ordinary
7 skill in the art would understand that the
8 drawings are simply illustrative, not instruction
9 that limits the claims.

10 And, in fact, that, as I mentioned before
11 this time and last time, the drawings are in such
12 poor quality, the resolution is so bad that -- and
13 so inconsistent that a person of ordinary skill in
14 the art would not be able to draw any definitive
15 conclusion from those figures.

16 Q So is it your opinion that a person of
17 ordinary skill in the art would not be able to
18 determine whether there are vertical sidewalls of
19 the landing pad in the figures in the '666 patent?

20 A No. I'm saying that even -- even if a
21 POSITA could recognize under these poor
22 illustrations and poor resolution, even if they

1 recognize that those figures depict vertical,
2 oriental -- oriented surfaces, those drawing are
3 merely illustrative example and should not be
4 imported into the claim term "side surface."

5 Q Do you dispute that the figures
6 illustrated in the '666 patent depict vertical
7 side surfaces between the landing pad and the
8 insulating layer?

9 A Again, this is a three-dimensional
10 structure and what all these figures shown are
11 two-dimensional cross-sections. So without a
12 three-dimensional drawing and the perspective in
13 the other orientations such as X-Y orientations or
14 Y-Z orientations, one would not definitively
15 conclude that the side surface is only oriented
16 vertically. There are side surface in oriental
17 [sic] -- horizontal, I'm sorry, horizontal
18 orientations and how that related to the
19 insulating layer in the other prospective, a
20 person of ordinary skill in the art would not be
21 able to determine that without explicit
22 illustration.

1 Q So where the patent gives an orientation
2 and it refers to horizontal surfaces as top and
3 bottom, and vertical surfaces as side surfaces, a
4 person of ordinary skill in the art would ignore
5 that in your opinion, correct?

6 ATTORNEY HERMAN: Objection. Form.

7 A No, I didn't say that. I'm saying that
8 the drawing just simply shows a cross-section. It
9 doesn't show explicitly what the -- the top and
10 bottom side surfaces look like. And so -- and as
11 I explained in paragraph 21, the purpose of the
12 description are not -- is simply a description,
13 not of limitations.

14 Q Turn to paragraph 22 of your reply
15 declaration.

16 A Okay.

17 Q Okay. You note in paragraph 22 that both
18 the terms "horizontal" and "vertical" are not
19 included in claim 19, correct?

20 A Right claim 19 does not have those terms.

21 Q Now, the specification does expressly
22 define "horizontal" and "vertical," correct, as

1 you noted in the paragraph 22?

2 A Right. In my first sentence of
3 paragraph 22 of the '666 patent "defines both the
4 term 'horizontal' ('nominally parallel to the
5 lateral surface of a substrate') and 'vertical'
6 ('nominally perpendicular to the lateral surface
7 of the substrate).'"

8 Q Does the patent ever use the term
9 "vertical" to refer to a top or bottom surface?

10 A The word "vertical" or the phrase
11 "nominally perpendicular" is in reference to the
12 substrate top surface, and it does not use
13 "vertical," the term "vertical" to refer to the
14 substrate top surface. Is that what you're
15 asking?

16 Q Does the patent ever use the term
17 "vertical" to refer to a top or bottom surface?

18 A As I mention many times, including this
19 time and opening declaration, reply declaration,
20 that whether the specification use the word to
21 define "top surface" or not, it doesn't change the
22 understanding of claim 17 that the inventor could

1 have used these particular surfaces in claim 17
2 but deliberately chose not to.

3 So we talk about this many times, and I
4 don't know why we're dwelling on this again.

5 Q So you mentioned --

6 A Many --

7 Q -- you mentioned -- you talked about this
8 many times, so let me just ask you this question.
9 Are you aware of any instance in the '666 patent
10 where the term "vertical" refers to a top or
11 bottom surface?

12 A Again, that the -- and I answered the
13 question, that the '666 patent does not use the
14 term "vertical" to refer to top surface, but that
15 doesn't not [sic] mean that the claims -- that
16 these language should be imported into the claim
17 language of claim 19.

18 Q Does the patent ever use the term
19 "horizontal" to describe a side surface?

20 ATTORNEY HERMAN: Objection. Form.

21 A The '666 patent expressly define what
22 vertical and horizontal means, but at the same

1 time you also remember that the -- earlier we talk
2 about that this is orientation-dependent. You
3 could rotate the device 90-degree and has
4 different orientation completely. But the more
5 important thing is that the -- these terms are
6 absent in claim 17 and 19. A POSITA would
7 understand that the claim intentionally omit any
8 orientation requirement and cannot limit -- cannot
9 be limited to a vertical size as Dr. Giapis
10 suggested.

11 And more importantly, in paragraph 64, the
12 last sentence of paragraph 64, that even under the
13 patent owner's construction -- which I disagree
14 with -- the prior art would still yield a pad of a
15 curved side surface in contact with insulation --
16 insulating layers, as required by claim 17 and 19.

17 So all these questions and debate about
18 what, you know -- what orientation is claim 19
19 means when they talk about curved side surface, in
20 terms of invalidity, it's irrelevant.

21 I, you know -- so even if Dr. Giapis and
22 patent owner's narrow construction is adopted,

1 which I don't think it will; that is, that the
2 curved side surface is in a z-direction, I don't
3 know why you want to waste time on this, because
4 the prior art would still invalidate claim 19 as
5 discussed in paragraph 64 in my reply declaration.

6 Q I'm not interested in wasting time. I
7 just want to know --

8 A But you are.

9 Q Let me just ask this question -- let me
10 ask you this question: Are you aware of any
11 instance in the '666 patent that uses the term
12 "horizontal" when describing a side surface?

13 A I already answered that.

14 ATTORNEY HERMAN: Objection. Form. Asked
15 and answered.

16 Q Is the answer no?

17 A I already answered that. You can look
18 back and see my answer.

19 Q So you're not aware of any instance in the
20 '666 patent that uses the term "horizontal" when
21 describing a side surface?

22 ATTORNEY HERMAN: Objection to form. Also

1 asked and answered and argumentative.

2 A I already have answered that.

3 Q What is that answer? I'm still not sure
4 what it is, so I want to --

5 ATTORNEY HERMAN: Same objection. He says
6 he answered it.

7 ATTORNEY WATSON: I'll ask the question
8 again. Let me ask the question again, and let me
9 just see what the answer is.

10 Q Are you aware of any instance in the '666
11 patent that uses the term "horizontal" when
12 describing a side surface?

13 ATTORNEY HERMAN: Objection. Form. Asked
14 and answered. Argumentative and badgering the
15 witness.

16 A The '666 patent expressly defined vertical
17 and horizontal, yet it does not use these terms in
18 claim 19 or 17. Furthermore, as we discussed
19 earlier, that orientations is relative, especially
20 when you are allowed to rotate the subject or the
21 apparatus by 90-degree or any angle you want.

22 So the answer to your question is that,

1 even though one might conclude that -- which is
2 not exactly accurate, if a person of ordinary
3 skill in the art using that paragraph and say
4 that, oh, horizontal -- the patent never use the
5 word "horizontal" to describe side surfaces, I
6 think it needs to be qualified by what I just
7 said.

8 And even though -- even if one can
9 conclude that -- and it seems like Dr. Giapis and
10 patent owner likes to conclude that and likes to
11 use the narrow claim construction, that the prior
12 art would still invalidate claim 19, as I describe
13 in paragraph 64 in my declaration, reply
14 declaration.

15 Q Does the patent ever use the terms "top"
16 or "bottom" to refer to a vertical surface?

17 A Can you repeat that question?

18 Q Does the '666 patent ever use the terms
19 "top" or "bottom" to refer to a vertical surface?

20 A To describe what?

21 Q Does the '666 patent ever use the terms
22 "top" or "bottom" to refer to a vertical surface?

1 ATTORNEY HERMAN: Objection. Form.

2 A Does the '666 patent ever use the terms
3 "top" and "bottom" to describe side surfaces? Is
4 that what you mean?

5 Q Vertical surfaces.

6 ATTORNEY HERMAN: Same objection.
7 Objection to form.

8 A So in the '666 patent, the top and bottom
9 are used -- generally not used to describe
10 vertical surfaces. The top and bottom refer to
11 orientations relative to the substrate, right?
12 The top surface facing away from the substrate,
13 meaning upward; the bottom surface facing away
14 from the substrate, meaning downward.

15 And -- but, again, remember that all these
16 are relative because the apparatus can be oriented
17 and rotate 90-degree or any other rotation, so
18 it -- it doesn't matter whether it distinguishes
19 top and bottom surface from vertical in -- in the
20 patents, in the specification, because those are
21 just example; they're not to be -- to be imported
22 into the claim, especially claim 17 and 19.

1 Q So you are not aware of any instance in
2 the '666 patent where the term "top" or "bottom"
3 is used to describe a side surface, fair?

4 ATTORNEY HERMAN: Objection. Form.

5 A I believe I answered that. The '666
6 patent use -- uses the terms "top" and "bottom" to
7 describe surface nominally parallel to the
8 substrate and not the vertical surfaces. However,
9 once again, these are just illustrations, an
10 example, and nonlimiting.

11 Q Where does the patent use the terms "top"
12 or "bottom" to refer to a side?

13 A Did I say that?

14 Q Well, let me ask -- let me change the
15 question.

16 Does the '666 patent use the words "top"
17 or "bottom" to refer to a side?

18 A Again, I think I just answered that. The
19 '666 patent use the terms "top" and "bottom" to
20 describe surfaces nominally parallel to the
21 substrate, not the vertical surfaces. Okay?
22 And -- but a person of ordinary skill in the art

1 reading -- understanding the term "side surfaces,"
2 in the plain and ordinary meaning, means that it
3 can be any surface, any side. It's not limited to
4 vertical only.

5 Whether the specification of '666 patent
6 use the term "top" and "bottom" to relate to the
7 side surface is irrelevant because "side surface,"
8 in plain and ordinary meaning, it means any
9 surface, any sides. It can mean the top side
10 surface, it can mean the bottom side surface, and
11 it could mean the top side, bottom side and so on
12 and so forth.

13 So it doesn't matter whether the claims --
14 whether the specification directly refer to the
15 top and bottom as side surface. A person of
16 ordinary skill in the art would understand in
17 plain and ordinary meaning in the claim 17 and 19
18 that means any side, any surface.

19 Q So you're not aware of any place in the
20 '666 patent where the patent uses the words "top"
21 or "bottom" to refer to a side. Is that fair?

22 ATTORNEY HERMAN: Objection. Form. Also

1 mischaracterizes the witness's testimony.

2 A Again, the '666 patent uses the terms
3 "top" and "bottom" to describe surfaces nominally
4 parallel to the substrate, not vertical or -- not
5 vertical surfaces. And if you want to say, you
6 know, not side surface, but the -- but that
7 doesn't mean that the plain and ordinary meaning
8 of "side surface" cannot be top surface or bottom
9 surface because plain and ordinary meaning of
10 "side surface" is any surfaces as I describe in
11 paragraph 12 or paragraph -- what is it that I
12 showed in a -- that I showed the drawing of 12, as
13 I describe in paragraph -- yeah, paragraph 12 on
14 page 5.

15 Q Okay. Can you point to me -- strike that.
16 Does --

17 A Excuse me. Can you hold on one second?

18 ATTORNEY WATSON: Sure. Let's go off the
19 record if you need to go off the record.

20 THE WITNESS: Thank you.

21 (An off-the-record discussion was held at
22 this time.)

1 Q Dr. Lee, sitting here today, are you able
2 to identify any part of the '666 patent that uses
3 the words "top" or "bottom" to refer to a side?

4 ATTORNEY HERMAN: Objection. Form.

5 A Well, if you look at column 4, as I
6 mentioned, that the plain and ordinary meaning of
7 "side surface" is any side, any surfaces. And the
8 claim says only side surface. It doesn't say
9 lateral, it doesn't say vertical, horizontal side
10 surface. So it could be any surface along the x-y
11 plane, X-C plane, Y-C plane, or any other
12 surfaces.

13 And your question is whether the patent
14 ever used top surface or bottom surface relate to
15 side surface. And in column 4, you can see that
16 it says that the bottom surface is opposite to the
17 top surface, and therefore, bottom side of the
18 substrate is opposite to the top side of the
19 substrate.

20 And -- so even though it does not
21 explicitly say side surface, but it implicitly, a
22 person of ordinary skill in the art reading that

1 would also understand that when they talk about
2 bottom, it also means a bottom side, meaning that
3 it is a bottom side surface. And so it is -- it
4 is -- and when they talk about top, it's -- top
5 surface is also related to the top side surface.

6 So in all of those, top surface and bottom
7 surfaces, a person of ordinary skill in the art
8 would have understood that as one of the side
9 surfaces.

10 Q Okay. Let's go to paragraph 25 of your
11 declaration.

12 You state here that "the patent includes
13 no views of its memory device" --

14 A Hold on. One second, one second. Sorry.
15 I'm sorry. Paragraph 25?

16 Q Mm-hmm.

17 A Yes.

18 Q You state that "the patent includes no
19 views of its memory device in the X-Y direction,"
20 correct?

21 A That's right.

22 Q Are there any processes described in the

1 '666 patent that would form a curved side surface
2 that is curved along the X-Y direction?

3 ATTORNEY HERMAN: Objection. Form.

4 A I believe that I have answered that in my
5 reply declaration and as well in my opening
6 declaration, because these are not new opinion --
7 opinions.

8 In my reply declaration in paragraph 23 to
9 30, that number 1, claim 19, claim 17 are
10 apparatus claim, and it's not directed to any
11 particular manufacture -- manufacturing recipe.

12 And so the -- and that's in paragraph 26
13 in my reply declarations, and not limit itself to
14 techniques such as PECVD or PVD, that the patent
15 owner relied on, and that's in paragraph 28.

16 And '666 patent does not discuss curved
17 flux component or directional that -- or isotropic
18 fluxes. That's in paragraph 27.

19 So to answer your question, is that, you
20 know, Dr. Giapis is wrong in importing the method
21 of manufacturing into claim 19 and claim 17, and
22 that it is not true that the method of

1 manufacturing in -- described in '666 patent only
2 produce or produce only a surface that is curved
3 along the z-axis.

4 Q Okay. But I don't think that answered my
5 question. I'm just asking, are there any
6 processes described in the '666 patent that would
7 form a curved side surface curved along the X-Y
8 direction?

9 A Well, the deposition techniques such as
10 LPCVD and ALD by themselves would not produce
11 vertically curved landing pad side surface like
12 those shown in the '666 patent. And these
13 techniques can, however, produce landing pad that
14 a curve in x-y plane, as I describe in
15 paragraph 29.

16 And patent owner and Dr. Giapis is wrong
17 in saying that poor step coverage will result in a
18 certain particular direction of curvature. Poor
19 step coverage is simply due to non-conformal
20 deposition and does not impose any particular
21 orientations or particular direction of curvature.

22 Q Okay. So let's go to paragraph 29 of your

1 declaration.

2 A Okay.

3 Q You state that "These techniques can
4 produce" -- "can, however, produce landing pads
5 that are curved in x-y plane (using appropriate
6 shaped mask during deposition)."

7 Do you see that?

8 A Right.

9 Q Where does the '666 patent say anything
10 about using a shaped mask?

11 A I'm saying that a -- first of all, the
12 patent does not limit itself to deposition
13 technique such as plasma-enhanced CVD or
14 directional sputter deposition PVD. It also talks
15 about low pressure CVD and atomic layer deposition
16 ALD. Okay?

17 And so a person of ordinary skill in the
18 art understanding low pressure CVD or ALD would
19 understand that it can produce curvatures, landing
20 pad that are curved in the x-y plane, even though
21 '666 does not explicitly say that in the
22 specification, that a person of ordinary skill in

1 the art would understand that.

2 And the patent also does not explicitly
3 say that it will result in a curved side surface
4 in a vertical direction, as Dr. Giapis and the
5 patent owner tried to try to conclude, which is
6 totally incorrect based on the understanding of a
7 person of ordinary skill in the art.

8 So -- and the key -- the key point is that
9 claim 19 and claim 17 are apparatus claims. And
10 Dr. Giapis and the patent owner try to import any
11 particular manufacturing process, a recipe, into
12 the claim is, in my understanding of the legal
13 patent -- legal aspect, is totally inappropriate.

14 Q Okay. So you agree that the '666 patent
15 specification does not expressly say anything
16 about using a shape mask, fair?

17 ATTORNEY HERMAN: Objection. Form. Also
18 mischaracterizes the witness's testimony.

19 A The patent does not say anything about --
20 explicitly say anything about curve in the
21 vertical direction. In fact, the specification of
22 '666 patent does not use the word "curve" at all.

1 Okay? And so the fact that Dr. Giapis and the
2 patent owner try to import the understanding of
3 the manufacturing recipe and draw a conclusion
4 that it is describing a -- a vertical, curved
5 structure is, I believe that it's -- a person of
6 ordinary skill in the art would see that as
7 completely incorrect.

8 Q So I'm not asking you about curvature and
9 Z plane, or Dr. Giapis's opinion. I just want to
10 know and just want to confirm, does the '666
11 patent say anything about using a shaped mask?

12 ATTORNEY HERMAN: Objection. Form. Also
13 asked and answered.

14 A You know, if a person of ordinary skill in
15 the art would understand the -- the process, I'm
16 saying that '666 patent does not say anything
17 about landing pad being curved in the vertical
18 direction or in the z-direction. And if, by the
19 same token that Dr. Giapis and the patent owner,
20 importing the understanding of manufacturing
21 recipe into the claim language, one would be -- a
22 person of ordinary skill in the art would

1 understand that the technique described in '666
2 patent can also produce landing pads in the --
3 that are curved in the x-y plane using the
4 appropriate shaped mask during the deposition,
5 even though it does not explicitly -- the '666
6 patent does not explicitly say anything about --
7 saying the shaped mask during deposition, nor does
8 it say landing pad are curved in the vertical
9 direction.

10 Q The '666 patent never says anything about
11 using a shaped mask during deposition, fair?

12 ATTORNEY HERMAN: Objection. Form. Also
13 asked and answered.

14 A That the '666 does not explicitly say
15 using a shaped mask during the -- during the
16 fabrication. However, I'm drawing the
17 understanding of the patent -- of the
18 manufacturing technique. And to -- to say that
19 one can generate a landing pad that are curved in
20 the x-y plane, and all it does to the incorrect
21 and inappropriate conclusion that Dr. Giapis and
22 Dr. -- and the patent owner draw an arbitrary --

1 arbitrarily conclusion that using non -- using
2 poor step coverage to produce a curved surface or
3 to produce a landing pad that are curved in the
4 z-direction.

5 Q Let's go back to paragraph 26 of your
6 report.

7 A Okay.

8 Q You refer to Dr. Giapis's opinion that "a
9 person of ordinary skill in the art would have
10 selected and optimized specific gas-phase
11 deposition techniques capable of supplying both
12 directional and isotropic fluxes of depositing
13 molecules to the staircase structure."

14 Do you see that? Where you refer to that
15 opinion?

16 A Yes.

17 Q Will using gas-phase deposition techniques
18 capable of supplying both directional and
19 isotropic fluxes of depositing molecules to the
20 staircase structure form a curved side surface?

21 A The simple answer is no. The direction
22 those sputter deposition PVD will produce a

1 non-conformal -- non-conformal deposition, a poor
2 step coverage and would not -- one would not
3 automatically conclude that it will produce a
4 curved side surface in the vertical direction.

5 Q Could it produce a side surface in the
6 vertical direction?

7 ATTORNEY HERMAN: Objection. Form.

8 A Once again, you could -- you know, if a
9 person of ordinary skill in the art looking at
10 the -- understanding the plasma-enhanced CVD or
11 directional sputter deposition would simply
12 conclude that this is a very poor process, would
13 result in poor step coverage and non-conformal
14 deposition, unless you do subsequent annealing or
15 densification.

16 And just going from that and jump to a
17 conclusion that would result in a curved side
18 surface in vertical direction is laughable.

19 Q Let's go to paragraph 29 of your report,
20 your reply report, reply declaration.

21 A Yes, sir.

22 Q You're there?

1 A Yes, sir.

2 Q You state, "A person of ordinary skill in
3 the art" -- or a POSITA -- "would understand that
4 non-conformal deposition can produce curvature in
5 different directions depending on future geometry,
6 shadowing, and mask shape, rather than only in the
7 z-direction."

8 Do you see that?

9 A Yes, I see that.

10 Q So a person of ordinary skill in the art
11 could use non-conformal deposition curvature
12 techniques to form curvature in the z-direction.
13 Is that fair?

14 A You could, but is -- again, it really
15 depends on the features, geometry, shadowing, the
16 mask shape. So one cannot infer a specific
17 direction of curvature simply based on this
18 method.

19 So the -- what I'm saying there is, in
20 plain English, curvature direction depends on
21 geometry, not just deposition. A POSITA would
22 understand that when the deposition is

1 non-conformal, which is what Dr. Giapis and the
2 patent owner relied on, that when the direction --
3 when the deposition was non-conformal, the
4 direction of the curvature really depends on many
5 things: the feature shape, the shadowing, aspect
6 ratios, the mask geometry, and therefore, the
7 curvature could appear in the X-Y direction, the
8 X-Z directions and the X -- Y-Z direction, or any
9 multiple directions.

10 So to conclude that it would only result
11 in z-direction is -- is inappropriate and it's
12 completely wrong.

13 Q Is there any description in the '666
14 patent of producing curvature using non-conformal
15 deposition?

16 A So the -- that is what Dr. Giapis and the
17 patent owner relied on using non-conformal
18 deposition to conclude that it will result in
19 curvature in the z-direction. And the '666 patent
20 does not say that.

21 A non-conformal deposition is well-known
22 to just simply result in poor step coverage,

1 meaning a -- a layer that is in very poor
2 characteristics, and why would anybody use that to
3 form any -- anythings to just simply try to
4 satisfy a certain limitation.

5 Q Let's turn to Figure 6 of the '666 patent.

6 ATTORNEY WATSON: Put it up on the screen.

7 Q Are you there?

8 A Yes.

9 Q Figure 6 of the '666 patent shows poor
10 step coverage, correct?

11 A Yes.

12 Q And do any of the figures in the '666
13 patent show good step coverage?

14 A Figure 6 shows a poor step coverage, also
15 called -- or you can think of partially -- partial
16 coverage, not uniform. And -- so that it result
17 in uneven thickness.

18 So that doesn't mean that it will
19 automatically result in a curved side surface in
20 the z-direction, and -- and the patent does
21 describe conformal deposition in Figure 3.
22 Figure 3 illustrates a cross-sectional view of the

1 staircase structure 300 with material, 310,
2 disposed thereof, according To some embodiments.
3 Material layer is conformally disposed on the
4 staircase structure.

5 So yes.

6 Q Would you agree with me that some
7 embodiments of the '666 patent show poor step
8 coverage and some include good step coverage?

9 ATTORNEY HERMAN. Objection. Form.

10 A You mean the figures?

11 Q The embodiments themselves.

12 A Yeah, they both discuss conformal and
13 non-conformal deposition.

14 Q Okay. Are there any examples -- strike
15 that.

16 Would following the steps -- strike that.

17 Would following the manufacturing process
18 discussed in the '666 patent form a curved side
19 surface?

20 ATTORNEY HERMAN: Objection. Form.

21 A The simple answer is no.

22 Q Okay.

1 A Because, as I discuss in paragraph 29,
2 that Dr. Giapis and the patent owner try to use
3 non-conformal deposition that result in poor step
4 coverage and concluded that that could be used to
5 result in curvature in a z-direction. As I
6 describe in paragraph 29, that the -- the
7 curvature can produce -- I mean, these
8 non-conformal deposition really can produce
9 curvature in various directions. It really
10 depends a lot on the details of the -- of the
11 processing, including the feature geometry,
12 whether it's micron range or nanometer range,
13 shadowing effect, the shape of the mask and the
14 aspect ratio and so on and so forth.

15 Q So in your opinion, a person of ordinary
16 skill in the art would not be able to follow the
17 steps listed in the '666 patent to form a curved
18 side surface?

19 A I don't know what you mean by "step."
20 There is no steps. I mean, all I did say is a
21 non-conformal deposition would result in Figure 6
22 without any details whatsoever.

1 Q Let's turn to paragraph 33 of your reply
2 declaration.

3 A Okay.

4 Q In paragraph 33, you cite an image of a
5 staircase structure that was discussed during the
6 prosecution history of a related patent, correct?

7 A Yes.

8 Q Now, do you see the landing pad in that
9 structure?

10 A Yes.

11 Q Under your understanding of a side
12 surface, how many side surfaces are there of that
13 landing pad?

14 A So as I describe in paragraph 34, right,
15 that "In discussing the structure shown in this
16 figure, the examiner explained that the memory
17 staircase includes a 'landing pad' with '4 side
18 surfaces: A, B, C, and D,' where A -- 'Sides B
19 and D' (the top and bottom) corresponded to the
20 claimed 'side surfaces.'"

21 And I think the examiner missed two other
22 surfaces. You have surface -- the top surface D,

1 the bottom surface B, the lateral surface --
2 surfaces A and C, but you also have surface that's
3 in the -- facing -- facing the audience. In other
4 words, in the Z-X direction, one in the front and
5 one in the back of the -- of the -- of the landing
6 pad.

7 So there's actually six sides, just like
8 when you have a dice that you have -- when you
9 have a dice, you have six sides.

10 Q So the landing pad in this figure that you
11 reproduce in paragraph 33 of your reply
12 declaration has six side surfaces, correct?

13 A Right.

14 Q And two of those side surfaces are the top
15 and bottom surface, fair?

16 A B and D.

17 Q B and D.

18 And then there's four side surfaces that
19 would be -- assuming this is oriented in an X-Z
20 plane -- would be vertical; is that fair?

21 A That's kind of simplistic, once again,
22 that it depends on the orientation. In an A and C

1 and the front side surface and the back side
2 surface, and those are substantially perpendicular
3 to the substrate top surface. And if you want to
4 call that vertical, that's fine, but it is -- I
5 try not to do that because, once again, that a
6 apparatus can be rotated, you know, 90 degrees or
7 any other orientation.

8 Q Let's go to paragraph 35 of your
9 declaration.

10 A Yes.

11 Q You that the applicant "amended the claims
12 to require surfaces that are substantially
13 perpendicular to a top surface of the substrate."

14 Do you see that?

15 A That's what it says there.

16 Q Okay. That amendment didn't limit the
17 term "curved side surface," correct?

18 ATTORNEY HERMAN: Objection. Form.

19 A You know, it's been a while since I looked
20 at that prosecution. And so I need to look at
21 that more carefully before I can answer that
22 question.

1 Q Okay. So you don't know one way or the
2 other based on what you have here in your reply
3 declaration?

4 A I'm saying that without looking at the
5 details of the prosecution history of the '956
6 patent, one would not be able to answer your
7 question.

8 Q Okay. Now, this -- you note that the
9 applicant specified that the "side surfaces were
10 substantially perpendicular to the top surface of
11 the substrate." Is that right?

12 A That's what I had written in paragraph 35.

13 Q What's the difference between
14 "substantially perpendicular" and "nominally
15 perpendicular"?

16 A You -- perhaps you can answer that for me
17 because you're the lawyer. The -- let me think
18 about this.

19 Earlier, we talked about nominally, right?
20 And I believe that we all conclude that
21 "nominally" means approximate -- approximately.
22 So I -- to be honest, I think -- legally, I don't

1 know exactly what is the -- the difference, but in
2 plain English, I would think that "substantially"
3 means mostly substantially perpendicular, mostly
4 or largely perpendicular. And with some -- with
5 some tolerance.

6 "Nominally," I think is related to --
7 "approximately" is described. It's in --
8 approximately or generally perpendicular.

9 So they're very, very similar based on my
10 understanding, but, again, I'm not a lawyer, so
11 you can tell me.

12 I think "substantially," if I understand
13 correctly, is more related to the claim's
14 limitation, and "nominally" is more described in
15 the -- they're described in literature or in the
16 specification.

17 And so -- but, again, I'm not -- I'm not a
18 lawyer, so I wouldn't -- I'm sure that what I
19 recall or try to understand, like what I just
20 said, might be totally incorrect. But that's my
21 understanding. They both -- they both seem, in my
22 mind, "substantially" or "nominally," in plain

1 language, English seems to be very similar.

2 But if I recall correctly, based on my
3 other cases, one is more applied to claims and one
4 is more in general discussions.

5 What do you think, Tom?

6 Q Well, let me ask you this: In preparing
7 your reply declaration, did you consider a
8 difference between "substantially" and "nominally
9 perpendicular"?

10 A Well, all I'm saying here, okay, what I
11 want to conclude is that in the -- all I want to
12 say over here is that in the prosecutions of the
13 '956 patent, the claims specifically specify that
14 the side surface is substantially perpendicular to
15 the surface substrate. Okay? And the -- but the
16 '666 patent does not say anything about that, and
17 so therefore, a person of ordinary skill in the
18 art would understand that -- an understanding of
19 the '666 patent, not the '596 [sic] patent, that
20 side surface is -- should be interpreted based on
21 plain and ordinary meaning; in other words, it
22 means any side, any surfaces.

1 And that's why I draw that discussion
2 to -- to understand why a person of ordinary skill
3 in the art, from reading the prosecution history
4 of the '956 patent, one of the '666 patent's
5 parents' applications, and whether it is used --
6 whether the word is "substantially" and
7 "nominally," based on my understanding, is that
8 '956 patent specify what the orientation is of the
9 side surface and '666 does not.

10 Q I'm not sure that's responsive, but let's
11 just take a break right now if that's --

12 THE WITNESS: How much more do you have,
13 sir?

14 ATTORNEY WATSON: How long -- how long?

15 THE WITNESS: How much longer? Because --

16 ATTORNEY WATSON: Let's take a break.
17 Let's go off the record and we can talk about
18 that.

19 (Recess.)

20 ATTORNEY WATSON:

21 Q Dr. Lee, let's turn to Exhibit 1005, which
22 I've put in the chat for you. Let me know when

1 you're there.

2 A I'm there.

3 Q Okay. Exhibit 1005 is the Kim reference
4 you discuss in your declarations, correct?

5 A Yes.

6 Q All right. Let's go to column 12 of Kim.
7 Column 12, lines 14 through 19.

8 A Column 12, line what?

9 Q Lines 13 through 19. Are you there?

10 A Yes.

11 Q Figures 10 through 18 of Kim illustrates
12 operations of a method of manufacturing a
13 semiconductor device, correct?

14 A That's what it says there.

15 Q Okay. And if you'll go down to column --
16 or row 30. I'll give you a second.

17 In this method taught by Kim, a plurality
18 of insulating layers 110 in sacrificial layers 120
19 are formed using thermal CVD, plasma-enhanced CVD,
20 physical CVD, or atomic layer deposition process,
21 correct?

22 A Right.

1 Q The insulation layers 110 are silicon
2 oxide, correct?

3 A Where are you reading?

4 Q Let's go up to column 12, lines 26 through
5 29.

6 A Right.

7 Q This insulation layers 110 are silicon
8 oxide?

9 A Yes.

10 Q Correct?

11 The sacrificial layers 120 are silicon
12 nitride, silicon oxynitride layers, or silicon
13 layers, correct?

14 A Right.

15 Q Now let's go down to column 12, lines 43
16 through 47.

17 After the sacrificial and insulation
18 layers are formed --

19 A Wait, wait, where are you?

20 Q Column 12, lines 43 through 47.

21 A 43, "For example"?

22 Q Yes. Are you there?

1 A Yes.

2 Q So in this Kim process, after the
3 sacrificial and insulation layers are formed, a
4 mask pattern is formed on the insulating layer 110
5 using the mask pattern as an etching.

6 Do you see that?

7 A Yes.

8 Q Now, have you ever heard of the term
9 "lithography"?

10 A Yes.

11 Q What is lithography?

12 A Well, lithography is a process where you
13 transfer the image of the mask onto the chip.

14 Q Okay.

15 A Of course a lot more detail, but
16 essentially photolithography is a process. In
17 fact, it's probably the most expensive steps
18 compared to all the others, deposition, etching
19 and all that. It's a process in the manufacturing
20 process where we transfer the pattern -- the
21 pattern from a mask onto the surface of the
22 semiconductor substrate.

1 Q So in the Kim process, once the mask
2 pattern is formed on the insulating layer 110, is
3 that when lithography is performed?

4 A "For example, a mask pattern may be formed
5 on the uppermost insulating layer 110, and the
6 uppermost insulating layer may be etched using the
7 mask pattern as an etching mask to expose a second
8 upper sacrificial layer 120 and the second upper
9 insulating" -- "second upper insulating layer
10 110."

11 So yeah, when they talk about mask pattern
12 is basically make use of the process called
13 photolithography.

14 Q Okay. So once the mask pattern is formed
15 on the insulating layer 110, the lithography is
16 performed, in Kim?

17 A I'm not sure what you mean by that.

18 Q So we were just talking about how a masked
19 pattern is formed on the insulating layer 110, in
20 Kim.

21 Do you see that in column 12, line 43
22 through 47?

1 A Yeah.

2 Q Okay.

3 A I think you're missing the point.

4 Q Okay. So I guess my question to you is,
5 when is the lithography performed in Kim?

6 A Well, from -- in many, many steps.
7 Photolithography is basically transfer the pattern
8 on the mask onto -- onto a photoresist, so-called
9 photoresist, on the -- on the substrate.

10 And so it involved many sub-steps:
11 photoresist coating, mask alignment, exposure,
12 development, pattern transfer, and then resist
13 removal. But that just forming the pattern on the
14 photoresist, which is then followed by etching
15 where you transfer to the -- transfer to the
16 actual layer underneath the photoresist.

17 Q Okay. So let's go back to the steps that
18 we've talked about in Kim. So first, the
19 sacrificial and insulation layers are formed,
20 correct?

21 A Yes, in Figure 10.

22 Q Yeah. And then a masked pattern is formed

1 on the insulating layer using the masked pattern
2 as an etching?

3 A Yes.

4 Q Let's turn then to Kim, column 12, lines
5 57 through 60.

6 A Mm-hmm.

7 Q After etching the insulating layer, the
8 auxiliary insulating layer 122 is formed on
9 substrate 100, correct?

10 A Yes.

11 Q And if you'll turn to column 9, line 29,
12 the auxiliary insulating layer 122 can be silicon
13 oxide, correct?

14 A Yes.

15 Q So in Kim, the silicon oxide in auxiliary
16 insulating layer 122 is not formed by oxidizing
17 silicon, correct?

18 A Wait. This is column 9?

19 Q Well, we're on column 12, lines 57 through
20 60.

21 A Column 12, line 57 to 60. Okay.

22 Q So after etching the insulating layer 110,

1 the auxiliary -- the auxiliary layer 122 is
2 formed -- then formed on substrate 100, correct?

3 A Right.

4 Q Okay. That auxiliary insulating layer 122
5 is silicon oxide?

6 A And where did you read that?

7 Q Line 59 and 60.

8 A Of column 12?

9 Q Correct.

10 A Yes.

11 Q Okay. So in Kim, the silicon oxide in
12 auxiliary insulating layer 122 is not formed by
13 oxidizing silicon from another layer, correct?

14 A Where did you conclude that?

15 Q Well, it says there, the auxiliary
16 insulating layer is formed on substrate 100,
17 correct?

18 A Where did you read that?

19 Q Column 12, lines 57 through 60.

20 A Yeah.

21 Q Are you there?

22 A Yeah.

1 Q Okay. So I just want to walk through the
2 process here.

3 So after the etching insulating layer, the
4 auxiliary insulating layer 122 is formed on the
5 substrate 100, correct?

6 A Yes.

7 Q And that auxiliary insulating layer 122
8 can be made of silicon oxide, correct?

9 A Yes.

10 Q And that silicon oxide is directly
11 deposited onto the step structure itself, correct?

12 A Yes.

13 Q It's not formed -- strike that.

14 The silicon oxide in Kim is not formed by
15 oxidizing silicon in another step?

16 A No, because at that point the steps
17 involve both the layer 110, which is silicon
18 oxide, and layer 120, which is silicon nitride.
19 So it can't really oxidize nitride that easily.
20 So layer 122 is deposited.

21 Q I think the answer just got confusing
22 there. Let me try to clarify that.

1 So in Kim, the silicon oxide is not formed
2 by oxidizing the silicon of other --

3 A Which silicon oxide?

4 Q Fair. The silicon oxide in auxiliary
5 insulating layer 122.

6 A That's right.

7 Q Now let's go to Kim, column 12, lines 61
8 through 64.

9 A Okay.

10 Q Are you there?

11 A Yeah.

12 Q In this process in Kim, after auxiliary
13 insulating layer 122 is formed, a mask pattern is
14 then formed on that auxiliary insulating layer
15 122?

16 A Right.

17 Q And so in Kim, the damaged region is the
18 auxiliary insulating layer 122.

19 ATTORNEY HERMAN: Objection. Form.

20 A Can you repeat that again?

21 Q Sure. A mask pattern is formed on the
22 auxiliary insulating layer 122, correct?

1 A Yes.

2 Q So in Kim, the region that is damaged is
3 the auxiliary insulating layer 122?

4 A Where did you read that?

5 Q Well, you're using a masked pattern onto
6 layer 122, correct?

7 A Yes.

8 Q So using a masked pattern involves
9 injecting -- damaging some portion of the layer,
10 correct?

11 A Well, it's an ion injection.

12 Q Okay. So -- fair. So when ion injection
13 is performed on the mask pattern, those ions are
14 being injected into auxiliary insulating layer
15 122, correct?

16 A That's right.

17 Q And so the region that is damaged from the
18 ion injection is the auxiliary insulating layer
19 122.

20 A Okay.

21 Q Let's go to column 13, lines 12 through
22 15.

1 After removing the photosensitive resin
2 pattern M, a buried insulating layer 125 is
3 formed, correct?

4 A Mm-hmm.

5 Q Now let's go to column 13, lines 55
6 through 67.

7 In the Kim process, a gap in the auxiliary
8 insulating layer 122, called opening 122_0, is
9 formed by removing the sacrificial layer 120.

10 A Mm-hmm.

11 Q Correct? Correct? If you can answer
12 "yes" or "no," that would be appreciated.

13 A Are you reading column 13?

14 Q Column 13, lines 55 through 67. I'm not
15 reading, but I'm trying to summarize what's in
16 there.

17 A "The opening 122_0 may be a region in
18 which the region 120_I doped with the
19 predetermined ion is removed from the auxiliary
20 insulating layer 122." Okay?

21 Q Okay. So my question is, in this process
22 in Kim, a gap in the auxiliary insulating layer

1 122, called opening 122_O, is formed by removing
2 the sacrificial layer 120, correct?

3 A Yes.

4 Q In Kim, only a small portion of the
5 auxiliary insulating layer 122 is removed, fair?

6 ATTORNEY HERMAN: Objection. Form.

7 A Well, 122_O is removed.

8 Q But not all of auxiliary insulating layer
9 122 is removed in the process in Kim?

10 A That's right.

11 Q And after the sacrificial layers are
12 removed, the gaps are filled with conductive
13 material to form PAD_B and PAD_P?

14 A That's right.

15 Q Now, we've just walked through the steps
16 that Kim discusses, fair, at a high level?

17 A Yes.

18 Q When does Kim use lithography during those
19 steps?

20 A Well, it used photolithography in
21 Figure 11, Figure 12, Figure 14, Figure 15, and
22 Figure 16. So, yeah, it may use a

1 photolithography each time it tried to etch
2 something.

3 Q Okay. So Kim uses lithography in this ion
4 implantation to create an etchable volume in
5 insulating layer 122. Is that fair?

6 A Well, it use photolithography each time it
7 tried to etch a certain portion of the -- of the
8 substrate -- of the -- of some layers in a
9 substrate.

10 Q And so when that material that is etched
11 is removed, it leaves a void behind which is
12 filled with the conductive material that forms the
13 pad, correct?

14 (Reporter clarification.)

15 THE WITNESS: P-A-D.

16 A So you're talking about particular steps
17 of -- pulling from Figure 16 to Figure 17. Is
18 that right?

19 Q Sure.

20 A Okay. So what's your question?

21 Q So my question is, when the material that
22 is etched is removed, that leaves a void behind

1 which is then filled with the conductive material
2 that forms the pad, correct?

3 A Yes.

4 Q So the shape of the pad in Kim is
5 determined by how this auxiliary insulating layer
6 is etched; fair to say?

7 A It depends on the -- more than that. It
8 depends on other steps as well, not just the --
9 not just the damage processing step.

10 Q What other steps determine the shape of
11 the pad in Kim?

12 A Well, it also depends on each step that
13 you etch the staircase, whether you etch it, you
14 know, in the -- whether the pattern is aligned
15 well, whether it's shifted to the left, shifted to
16 the right. And it also depends on the open -- the
17 implant dosage, the implant profile, the implant
18 energy.

19 And -- so there are many things. It's not
20 a single as you think, or as the figures tend to
21 illustrate.

22 Q So would you agree with me that the

1 manufacturing process taught in Kim uses
2 lithography to form the contact pad?

3 ATTORNEY HERMAN: Objection. Form.

4 A Photolithography is used in every single
5 processing in defining the features of the 3D NAND
6 structure, including the contact pad or the
7 landing pad.

8 Q All right. Let's put Kim to the side.
9 Let's go back to the -- your reply declaration --

10 A Okay.

11 Q -- paragraph 45 -- 44 and 45.

12 A One second.

13 Q Let me know when you're there.

14 A 44 to 45. Okay.

15 Q So you note that "Park teaches a rounded
16 pad can be achieved using an additional oxidation
17 step during the pad formation."

18 Do you see that?

19 A Yes.

20 Q And it's your opinion that when a person
21 of ordinary skill in the art applies Park's
22 oxidation method to Kim, they would arrived at the

1 claimed invention in the '666 patent, correct?

2 (Reporter clarification.)

3 ATTORNEY HERMAN: Objection to form.

4 A Yeah, it's a combination between -- a
5 combination of Kim techniques and Park's
6 technique.

7 Q Now, you rely in both your opening and
8 reply declaration on this Park reference, correct?

9 A Yes, I've used both Kim and Park and other
10 references.

11 Q And you claim that Park teaches a curved
12 side surface; is that fair?

13 A Well, it's not just my opinion. It's a
14 person of ordinary skill in the art reading Park
15 would understand that.

16 Q If Park teaches a curved side surface, why
17 didn't you use Park as the primary reference in
18 one of your obviousness combinations?

19 ATTORNEY HERMAN: Objection. Form. Also
20 outside the scope of direct.

21 A What was the question again?

22 Q If Park teaches a curved side surface, why

1 did it use Park as one of the primary references
2 in your obviousness combinations?

3 ATTORNEY HERMAN: Objection. Form.
4 Outside the scope of direct. Counsel, this has
5 nothing to do with his reply declaration.

6 ATTORNEY WATSON: It absolutely does.

7 ATTORNEY HERMAN: It has nothing at all to
8 do with his reply declaration. Like, his choice
9 of prior art references, are you kidding?

10 ATTORNEY WATSON: He chose the prior art.
11 I'm asking him a question. He can answer the
12 question --

13 ATTORNEY HERMAN: Limit your questioning
14 to his reply declaration. Where in his
15 opinion did he -- in his reply declarations did he
16 offer an opinion about the choices he made about
17 prior art? Point that paragraph to me.

18 ATTORNEY WATSON: I think it's right
19 there, but I don't think this is proper.

20 ATTORNEY HERMAN: Point the paragraph to
21 me. Counsel, you're wasting everyone's time.

22 ATTORNEY WATSON: You're wasting our time.

1 I just asked him a question. If you have an
2 objection, you can object, but this is improper
3 for you to continue to coach your witness through
4 your objection.

5 ATTORNEY HERMAN: I'm not coaching. It's
6 objecting to your wasting of time and consuming
7 unnecessarily everyone's time.

8 ATTORNEY WATSON: I disagree. And if your
9 witness would answer the question --

10 (Simultaneous crosstalk.)

11 ATTORNEY HERMAN: Limit your question --
12 so I ask that you limit your questions to the
13 opinions in his reply declaration as the patent
14 office's rules require you to do.

15 ATTORNEY WATSON: We've been in his reply
16 declaration the entire time. We haven't -- we
17 almost never left his reply declaration.

18 Are we on the record still?

19 THE COURT REPORTER: Yes.

20 ATTORNEY WATSON: Okay. All right.

21 Well, let me ask a different question,
22 then.

1 BY ATTORNEY WATSON:

2 Q Dr. --

3 A Lee.

4 Q -- Lee, in paragraph 45 of your
5 declaration --

6 A Yeah.

7 Q -- it says that "Park teaches a rounded
8 pad can be achieved by performing an additional
9 'oxidation' step."

10 A Right.

11 Q Do you see that?

12 A Yes.

13 Q And then you opine that you would modify
14 Kim using that step?

15 A Yes.

16 Q What -- let's turn to -- which embodiment
17 in Park do you refer to when discussing how a
18 person of ordinary skill in the art would use Park
19 in conjunction with Kim?

20 A I don't understand what you mean by that
21 because Park is using oxidation-induced rounding
22 process, right?

1 Q Okay. Let's go to your opening
2 declaration, paragraph 208, real quick.

3 A Hold on one second. Let me find.
4 Okay.

5 Q So in your opening declaration, you refer
6 to the embodiment shown in Figure 7 from Park,
7 correct?

8 A Yeah.

9 Q Do you cite in either of your declarations
10 any other figure or embodiment from Park, other
11 than Figure 7?

12 A Sir, is it possible to upload Park?

13 Q Sure. I'm happy to do that.

14 ATTORNEY WATSON: Let's put up Park.

15 Q In the meantime, Dr. Lee, since my
16 question is related to your declarations, do you
17 have -- do you cite in your declarations any other
18 figure or embodiment other than Figure 7 from
19 Park?

20 A In paragraph 228 of my opening report, I
21 cited Figure 8.

22 Q Anything besides Figure 7 and Figure 8 of

1 Park?

2 A In paragraph 236, I cited column 7, line
3 17 to 29, which I believe is related to Figure 4
4 or Figure 5.

5 Q Okay.

6 A And then I also cited, in the same
7 paragraph, column 8, line 33 to 49, which is
8 related to Figure 6C.

9 Q Okay.

10 A And at the end of the paragraph, I also
11 cited column 9, line 3 to 11, cite Figure 6D to F.

12 Q All right. Let's --

13 A I'm not sure what's the intent of the
14 question because I'm using Park holistically, in
15 combination with Kim, to invalidate the claims,
16 claims 17 and claim 19 of the '666 patent.
17 Whether I use one figures or two figures or
18 multiple figures, multiple citation in the
19 specification, to me it's irrelevant.

20 Q Okay. Well let's go to Park. Let's go to
21 Park Figure 7 first. We'll go there. We'll put
22 it on the screen. Let me know when you're there.

1 A Yes, I'm there.

2 Q Okay. So in Park Figure 7, 79b is the
3 rounded end of pad portion 78, correct?

4 A One second. 79b?

5 Q Mm-hmm.

6 A In paragraph 404 of my opening
7 declaration, I said, "Park also explained that the
8 'end 79b' of this 'raised pad portion 78' may be
9 'rounded' to 'prevent a short circuit' between the
10 pad and the 'adjacent'...conductive layer pattern
11 72c."

12 Q So 79b is the rounded end of the pad
13 portion, correct?

14 A It's one end of the rounded landing pad
15 portion.

16 Q And layers 52a through 52f are the
17 insulating layers, correct?

18 A Yes.

19 Q Okay.

20 A Mr. Watson, I think we covered all of this
21 in my first deposition.

22 Q I actually don't think we did.

1 A I think we did.

2 Q We didn't talk much about Park.

3 A I think we did.

4 Q We'll continue. All right.

5 In Figure 7 of Park, the rounded surface
6 of the landing pad is not in contact with the side
7 surface of the insulating layer, correct?

8 ATTORNEY HERMAN: Objection to form. Also
9 outside the scope of direct.

10 A I'm not saying it does.

11 Q It doesn't, correct?

12 A In this figure it does not, but the point
13 is that's not -- that's not how I'm using Park in
14 combination with Kim.

15 Q And if you'll go to Park column 11, lines
16 63 through 65. Let me know when you're there.

17 A Yes.

18 Q "The interlayer, insulating [sic] layers
19 52a through 52f are formed of silicon oxide,"
20 correct?

21 A Yes.

22 Q And there's no listed definition of what

1 silicon oxide is in Park, correct?

2 A There's no definition of what silicon
3 oxide is in Park? Is that what you're saying?

4 Q Yes.

5 A A person of ordinary skill in the art
6 reading this prior art would understand that it
7 doesn't need it. Everybody knows what silicon
8 oxide is or oxide is. And it's not silicon
9 dioxide.

10 (Reporter clarification.)

11 Q Okay. Let's go to Figure 7 of -- back to
12 Figure 7 of Park. Are you there?

13 A Yes.

14 Q Okay. Can you point to me where the
15 oxidant is added in Park Figure 7 to form the
16 rounded pads?

17 A Well, it's due to the oxidation step as
18 shown in Figure 6C. Figure 6C is -- the
19 additional insulating layer 40 is formed by
20 oxidizing the surface and the side surface of the
21 step sacrificial layer patterns 14a through 14f
22 that are externally exposed.

1 Q So the oxidant is introduced into the
2 corners that are externally exposed, correct?

3 A I don't know how you said the corner is --
4 the oxidizing -- by oxidizing the surface and the
5 side surfaces of the step sacrificial layers,
6 layer patterns 14a through 14f that are externally
7 exposed.

8 Q I want to talk a little bit about how Park
9 forms the rounded end of the pad. Okay?

10 A Sure if you want to talk about it.

11 Q All right. Let's go to column 12, line 16
12 through 18.

13 A What is it again?

14 Q Column 12 of Park, line 16 through 18.

15 So in Park, after the sacrificial layers
16 and the insulating layers are formed, an
17 additional insulating layer 66 is formed by
18 oxidizing the surfaces of the sacrificial layer
19 pattern 62b through 62f, correct?

20 A Now we're switching to another embodiment
21 now.

22 Q Okay. We can go back to --

1 A No, go ahead and stay on this.

2 Q Okay.

3 A I -- I don't understand the reason for
4 this line of questioning.

5 Q Well, you can --

6 A If you don't understand it and you want
7 some explanation, I don't know what that -- what
8 you're trying to do in terms of invalidity, but
9 get to it, please.

10 Q Yes. I'm just asking you, after the
11 sacrificial layers and interlayer, insulating
12 layers are formed, an additional insulating layer
13 is formed by oxidizing the surfaces of the
14 sacrificial layer pattern 62b through 62f,
15 correct?

16 A You're referring to Figure 9C now?

17 Q I believe it's 9B.

18 A Okay. All right. You're reading from
19 column 12?

20 Q Correct.

21 A So what's the question?

22 Q My question is, do you see that?

1 A Yes.

2 Q So in Park, the silicon oxide in
3 insulating layer 68 [sic] is formed by oxidizing
4 the silicon nitride or polysilicon that's found in
5 the sacrificial layers, correct?

6 A Where are you reading?

7 Q Well, I was just reading that same
8 portion. I'm asking you as an expert what happens
9 to --

10 A No. Where exactly -- where exactly are
11 you reading?

12 Q I am looking at column 12, lines --

13 A 39.

14 Q 16 through 18.

15 A 16 through 18 didn't say anything about
16 68.

17 Q I think I said 66, but I'll --

18 A No. You said 68.

19 Q -- I'll repeat it. Sorry.

20 All right. So in column 12, lines 16
21 through 18, it says, "The additional insulating
22 layer 66 is formed by thermally oxidizing the

1 surfaces of the sacrificial layer pattern 62b
2 through 62f, correct?

3 A That's what you asked previously.

4 Q Okay. So my question to you is, the
5 silicon oxide that's an insulating layer 66 is
6 therefore formed by oxidizing the silicon nitride
7 or polysilicon that's found in the sacrificial
8 layers, correct?

9 A Yes.

10 Q Okay. And then if you'll go down to lines
11 24 through 29, "One end of the interlayer,
12 insulating layer patterns 52c through 52f can be
13 etched to form a recess 77," and that is shown in
14 Figure 9C, correct?

15 A Okay.

16 Q So if we go to Figure 9C, is it fair to
17 say that the silicon oxide in interlayer,
18 insulating layers 52a through 52f is not oxidized
19 when the oxidant is introduced?

20 ATTORNEY HERMAN: Objection. Form.

21 A Okay. So yeah, it's oxidized, the
22 sacrificial layer 62b to 62f, which could be

1 polysilicon layer and not the -- not the oxide
2 layer, which is 52a through 52f.

3 Q If the silicon oxide in Park were
4 oxidized, then the recessed portion 77, shown in
5 Figure 9C, would also be oxidized, correct?

6 A Yes, but obviously the process is designed
7 in such a way that it oxidizes the polysilicon and
8 not the oxidized oxide layer.

9 Q Why is the silicon oxide not further
10 oxidized when oxidant is introduced?

11 A Well, you can design in such a way that
12 polysilicon is oxidized and not the silicon
13 dioxide, depending on the ambience that you use,
14 depending on the temperature. There are all kinds
15 of ways --

16 (Reporter clarification.)

17 A Depends on the temperature you use and the
18 ambience that you use. So it is a very simple
19 optimization process.

20 Q Does the manufacturing process taught in
21 Park use lithography to form the contact paths?

22 A Yes. Every single step requires

1 depositions, etching, and photolithography.

2 Q All right. Let's go now to your reply
3 declaration. And we're going to go to paragraph
4 46.

5 A Okay.

6 Q Are you there?

7 A Yes.

8 Q Is the structure of a landing pad
9 determined by the manufacturing process used to
10 create it?

11 A Say it again? Is the structure of the
12 landing pad dependent on?

13 Q Is the structure of a landing pad
14 determined by the manufacturing process used to
15 create it?

16 A Of course.

17 Q So a person of ordinary skill in the art
18 would know that they cannot just form a curved
19 side surface without using a manufacturing process
20 that would form a curved side surface, correct?

21 ATTORNEY HERMAN: Objection. Form.

22 A I don't understand what you're talking

1 about. Obviously, every -- every step and the
2 structure and the resulting shape of the structure
3 is determined by the processing stamp that you
4 use.

5 Q Now, Kim does not discuss introducing
6 oxidant between oxide layers, correct?

7 A You said Kim does not discuss oxidation?

8 Q I asked if Kim discusses introducing
9 oxidant between the oxide layers.

10 A Not explicitly.

11 Q So you rely on Park's oxidation process to
12 describe how a person of ordinary skill in the art
13 would form the curved side surface, fair?

14 A Yeah, you can say that.

15 Q Now, let's turn to paragraph 48 of your
16 declaration.

17 A Which one?

18 Q Of your reply declaration.

19 A Okay.

20 Q You propose introducing oxidant into the
21 blue as shown in paragraph 48 of your reply
22 declaration, correct?

1 A Yes.

2 Q And only the external surfaces will be
3 oxidized, fair?

4 A I'm not sure what you mean by
5 "external" -- go ahead.

6 Q Introducing an oxidant won't round
7 internal surfaces of the interlayer, insulating
8 layer 122 in Kim, correct?

9 A Well, when you --

10 ATTORNEY HERMAN: Object to form.

11 A And I described that during my deposition
12 last time. During the -- when you introduce
13 oxidant into the corners, you have the concave
14 corners which you might -- someone might call it
15 interior corners and convex corner; somebody might
16 call that exterior corners.

17 So during that thermal oxidation, when you
18 introduce oxidant into the area that's shown in
19 figure -- in the figures, in paragraph 48, that
20 the exterior convex corners would oxidize faster
21 because they receive more oxidant flux from
22 multiple sources, from multiple directions, while

1 the interior corners or so-called convex, concave
2 corners, oxidize more slowly, because it is more
3 restricted access to the oxidants.

4 So the difference in the oxidation rate at
5 the corners versus the planar surface would cause
6 both types of the corners, convex and concave, to
7 round. So that would result in a rounded corners
8 in both a convex and concave corners.

9 So that's the mechanism that result in
10 rounded corners in the figures, Figure 16 in
11 paragraph 48. And we discussed that during my
12 last deposition. So it's not a new opinion. I
13 simply explained again what I said earlier last
14 time.

15 Q What is the material that makes up the
16 oxide layers in Kim Figure 16 that you cite in
17 paragraph 48 of your report?

18 A The material is silicon oxide. In other
19 words, it is not a silicon dioxide.

20 Q Okay.

21 A It is well-known that the -- so-called
22 non-stoichiometric silicon oxide is found in many

1 semiconductor structure including 3D NAND.

2 Non-stoichiometric oxide means that it's not SiO_2 ,
3 but rather SiO_x .

4 Now, in general, typically the numbers X
5 is between 1.7 to 1.9 or so. So these are
6 slightly non-stoichiometric.

7 Q Let's go to paragraph 89 of your reply
8 declaration real quick.

9 A Okay.

10 Q In paragraph 89 of your reply declaration,
11 you say that a person of ordinary skill in the art
12 would oxidize the oxide layers in Lee, correct?

13 A Yes.

14 Q Okay. Is the material in the oxide layers
15 in Figure 16 of Kim the same material used in
16 Lee's Figure 5B that you cite?

17 A I would say that -- I would say that a
18 person of ordinary skill in the art would
19 understand that the material would be
20 non-stoichiometric silicon oxide, and that the
21 same process and the same mechanism is known, in
22 other words, the oxidation of the convex and the

1 concave corners at a different rate compared to
2 the planar surface and therefore result in rounder
3 corners.

4 And whether they're identical to the other
5 figures, Kim is relevant that -- whether the --
6 SiO, or SiOx, a person of ordinary skill in the
7 art would understand that SiOx, non-stoichiometric
8 oxide, silicon oxide extremely common and widely
9 used in the -- in semiconductor industry,
10 especially 3D NAND.

11 But whether it's the -- whether it's SiOx,
12 the X value is the same, it's, you know, obviously
13 is -- is irrelevant as long as it is
14 non-stoichiometric, which is widely known.

15 Q Are there any meaningful differences in
16 oxidizing the oxide layers in Kim and oxidizing
17 the oxide layers in Lee?

18 A Well, the Lee figures in Figure 5B in
19 paragraph 89 and Figure 16 in paragraph 48
20 essentially showing that you have a -- you have
21 oxidant introduced into a non-stoichiometric
22 oxide. And in terms of the underlying mechanism,

1 there is no difference, that there is, basically,
2 oxidized the corners, convex and concave corner,
3 at a different rate as the planar surface that
4 result in a -- in rounded corners.

5 Q Let's turn to paragraph 47 --

6 A Let me check one thing. Even though Park
7 earlier showing the -- showing the oxidizing
8 process that to create a rounded -- rounded
9 landing pad is oxidizing polysilicon and not the
10 silicon oxide, it does not prevent a POSITA to
11 combine this oxidation-induced rounding process to
12 combine Park and Lee and Kim, and Park and Lee in
13 achieving rounded corner.

14 Basically, the underlying mechanism is the
15 same, using oxidation to induce rounding corners.

16 Q Let's turn to paragraph 47 of your reply
17 declaration.

18 A Okay.

19 Q Are you there?

20 A Yes.

21 Q And you claim that Kim's process can be
22 modified by adding an oxidant to the space between

1 oxide layers after Kim's sacrificial layers are
2 removed, as taught in Park, correct?

3 A Yes.

4 Q So we went through Kim's process
5 earlier --

6 A Yes.

7 Q -- so I just want to understand, how would
8 you modify Kim using this process? How --

9 A It's a --

10 Q Strike that.

11 How would Kim's process change to form a
12 curved side surface, using Park?

13 A It's a simple step. You simply introduce
14 a short oxidation steps to provide a rounded
15 corner before you fill the opening with metal
16 conductive layers to form the gate electrode and
17 the landing pad.

18 (Reporter clarification.)

19 A Forming the gate electrodes and the
20 landing pads.

21 Q So we discussed earlier the various steps
22 that happen in Kim's process? Do you remember

1 that we walked through each portion?

2 A Yes.

3 Q Okay. So you would perform the oxidation
4 process after the sacrificial layers are removed,
5 correct?

6 A Yes.

7 Q And at that stage, there is already a gap
8 in the insulating layer 122 called opening 122_O,
9 correct?

10 A So you remove the sacrificial layer and
11 then you perform a slight oxidation before you
12 fill in the sacrificial -- before you fill in the
13 gap with conductive layer.

14 Q I just want to make sure I have the right
15 stage here.

16 So let's go back to Kim. I have Kim,
17 column 13.

18 A Okay.

19 Q Let me know when you're there.

20 A I'm there.

21 Q So Kim column 13, line 55 through 67
22 describes forming a gap in auxiliary insulating

1 layer 122 by removing the sacrificial layer 120.

2 Do you see that?

3 A Column 13, line what?

4 Q Lines 55 through 67.

5 A So the gaps 260 is formed by removing the
6 insulating layer 122. Okay? So is there a
7 question?

8 Q So which -- does using the oxidation
9 process happen before or after this step?

10 A So you remove the -- you remove the
11 sacrificial oxide layer -- remove the auxiliary
12 insulated layer 122, which include 120_I and
13 120_O, and then -- after that, then you introduce
14 a small -- a short period of oxidant to rounded
15 the corner, followed by injecting -- followed by
16 depositing conformal deposition of the -- the gate
17 electrode. I believe it's 300.

18 (Reporter clarification.)

19 A Of the -- of the gate electrode.

20 Q So once the sacrificial layers are
21 removed, there's gap, correct, in Kim?

22 A Yes, of 260.

1 Q 260. And you're saying that a person of
2 ordinary skill in the art would modify Kim by, at
3 that step, adding oxidant to the auxiliary
4 insulating layer 122 to form a rounded side
5 surface, correct?

6 A Yes, before you put in the gate electrode.
7 Just as I describe in my reply declaration.

8 Q Let me go back to your reply declaration,
9 then. This is paragraph 48.

10 A Hold on one sec.

11 Okay.

12 Q Now, layer 122 is made of silicon oxide.
13 We've already established that, correct?

14 A Yes.

15 Q And layer 125 is also -- can also be made
16 of silicon oxide, correct?

17 A Yes.

18 Q Is layer 125 oxidizable?

19 A It could be.

20 Q So if you added oxygen to layers 122 and
21 125, both layers will expand, correct?

22 A Well, you have to remember, number one,

1 the oxidation rate of 125, which is a planar
2 structure, is slower than the corners of 122 and
3 122_0, just like 122 has a planar surface and a
4 concave and convex corners.

5 So therefore, yeah, 125, you could
6 oxidize, and which is an additive process, but the
7 oxidation is very slight. And also, oxidation
8 around the corner is going to be large -- faster
9 than the oxidation in the planar surface.

10 So as a result, you would end up with the
11 figure drawn in the circle that we highlight.

12 Q And when layers 122 and 125 are oxidized,
13 some of layer 125 will ultimately expand into the
14 space allocated for the pad, correct?

15 A Again, that amount is so little compared
16 to the corners. It's miniscuous [sic], and most
17 of the oxidant is basically contributing rounding
18 corner instead of oxidizing the 125, because of
19 the planar surface.

20 Q If oxygen were added to layers 122 and 125
21 in Kim, then the space for pad key would be
22 smaller due to the expansion of the layers 122 and

1 125, correct?

2 A Again, almost all the oxidation is at the
3 corners, not at the planar surface. So you would
4 not have a reducing height of the landing pad.
5 You simply have a rounded corner, which would
6 actually improve the characteristics of the -- of
7 the device because a rounded corner will prevent
8 shorting between the pads and the adjacent
9 conductive structure.

10 Q And the end result and figure -- in
11 figure -- strike that.

12 If you added oxidant to layers 122 and 125
13 in Kim, the end result would be what's shown in
14 the circle in your figure in paragraph 48 of your
15 reply declaration, correct?

16 A That is an illustrative drawing, that
17 since the oxidation rate on the planar surface is
18 slower than the oxidation rate around the corners,
19 almost all the oxidation occur at the corners and
20 not at the planar surface.

21 Q All right.

22 A This is very simple optimization

1 processes. We do it every day.

2 Q Okay.

3 ATTORNEY WATSON: Let's take a break. I
4 think we've been going about an hour and a half.
5 Off the record.

6 (Recess.)

7 BY ATTORNEY WATSON:

8 Q Dr. Lee, let's turn to paragraph 50 of
9 your declaration.

10 A Hold on. The reply declaration?

11 Q Yes. Correct.

12 A Okay.

13 Q In paragraph 50, you claim that it would
14 be obvious to employ Nam's process to obtain
15 landing pads with curved side surfaces in Kim,
16 correct?

17 A Yes.

18 Q You claim that the only change to Kim's
19 process needed to form a curved side surface is
20 adding an additional heating step, correct?

21 A Yes. Nam basically is applications of
22 heat after ion implantation which causes the

1 damage region to spread, resulting in a curved
2 contact pad, as discussed in paragraph 51 in my
3 reply declaration.

4 And let me emphasize, that, again, this is
5 not new. I discussed that in my opening report,
6 as well as my deposition.

7 So the -- the only thing is that I just
8 want to include a figure in paragraph, I believe
9 50- -- 52 to answer or clarify the confusion that
10 Dr. Giapis and the patent owners seem to have.
11 Again, it is not a new opinion, but I simply just
12 want to elaborate of what I said in my opening
13 IPR.

14 Q I've provided you with Exhibit 1006, the
15 Nam reference. Can you pull that up real quick.

16 A Sure. Okay.

17 Q Does the manufacturing process taught in
18 Nam use lithography to form the contact pad?

19 A Obviously forming the contact pad would
20 require photolithography.

21 Q And when does Nam use the lithography to
22 form the contact pad? What stage of the process?

1 A In every stage of the process. When you
2 think about it, how do you form a staircase
3 region? You etch one layer at a time. How do you
4 do that? By using photolithography.

5 Q Is the contact pad formed by using
6 lithography with the damaged region?

7 A You use an implant of the -- to introduce
8 a damaged region, and you don't want the implant
9 to implant an entire wafer, so you're going to
10 have to cover a certain part of the chip that you
11 don't want the damaged region. So therefore, what
12 do you do? Photolithography.

13 Q And where in Nam does it disclose that
14 covering of the damage region?

15 A You don't cover the damage region. You
16 cover the region that you don't want to damage.

17 Q And where in Nam does it disclose covering
18 the region that you don't want to damage?

19 A Look, you don't need to specify every
20 single step of the process. A person of ordinary
21 skill in the art reading a -- reading a patent
22 would understand that next step we're going to do

1 implantations, and wait a minute, doesn't it
2 require photolithography, doesn't photolithography
3 require spinning, a photoresist, heating --
4 develop -- expose to the mask, and then developing
5 the photoresist.

6 Do we need to spell every single step?
7 No. You basically put out the -- the
8 significant -- the important steps, the in-between
9 steps. A person of ordinary skill in the art
10 would understand that.

11 So I don't recall whether they -- whether
12 Nam explicitly indicating that there will be
13 photoresist steps. And I'll go take a look again.
14 But whether or not they actually talk about that,
15 in my mind, is irrelevant because it is
16 well-understood that you would use
17 photolithography to determine where you implant
18 and where you don't implant.

19 So if you want, I can --

20 Q Let's go --

21 A Do you understand what I'm saying, Mr. --

22 Q Yeah. Go ahead.

1 A So let me -- let me -- there are many
2 places. For example, in Figure 14 -- 13 and 14,
3 they talk about using masks, layer, and in other
4 places talk about using masks. But whether
5 Figure 17, whether Nam specifically talks about
6 using masks or photolithography, a person of
7 ordinary skill in the art would understand looking
8 at these pictures and understanding the -- the
9 processing of photoresist step and the mask layer
10 would have to be used.

11 Q Let's turn to Nam paragraph 67.

12 Let me know when you're there.

13 A 67, yeah.

14 Q So in Nam, there is a doped region 271A,
15 where the "impurity, having been injected into the
16 interface, is diffused and remains during the
17 manufacturing process of the memory device 200."

18 Do you see that?

19 A Yes.

20 Q So in Nam, the region is only etched out
21 when the ion concentration is larger than a
22 certain value. Is that fair to say?

1 A Hold on. This is about Figure 8A, I
2 believe.

3 Are you talking about paragraph that
4 says, "On the other hand"?

5 Q Yes, 67.

6 A So what was the question?

7 Q Sure. In Nam, the doped region is only
8 etched when the ion concentration is larger than a
9 certain volume.

10 A So in that paragraph, Nam is saying that
11 part of the insulating layer, layer 271, contain a
12 doped region, 271A, where the impurity had
13 diffused and remained during fabrications, right?
14 The doped region formed only on the top surface
15 but also in the lateral side -- lateral surface,
16 the side surface of the gate electrode.

17 So Nam teaches that the impurity diffusion
18 form a doped region on both the top and the
19 lateral surfaces of the gate electrode layers, I
20 believe with higher -- with high impurity
21 concentration on the side surfaces.

22 (Reporter clarification.)

1 A Yes, confirming that side surfaces are
2 explicitly modified, right, and structurally
3 significant in the -- in the process, in the
4 disclosed process.

5 Q So in Nam, the regions that are damaged
6 can be etched dependent on the ion concentration
7 in each region. Is that fair to say?

8 A Where did you read that?

9 Q I'm not reading it. I'm trying to
10 summarize what you're saying. I'm asking you
11 about how the amount of ion concentration in each
12 region affects the etching and what's etched.

13 So maybe I can try a different question.
14 Is that all right?

15 How does the amount of ion concentration
16 throughout the damaged region affect what is
17 etched?

18 A Where do you see "etching"? What
19 paragraph are you reading?

20 Q Well, in paragraph 67, it says some of the
21 impurity remains throughout the manufacturing
22 process, correct?

1 A Yes.

2 Q In section other sections of Nam, it says
3 that parts that are doped and damaged are removed,
4 correct, and etched out?

5 A Where do you see that?

6 Q I believe we talked about it last time.
7 I may look at it a little bit later, but
8 let's -- let's move on. Let's go to Nam -- let's
9 go to -- back to your reply declaration real
10 quick. And we'll go to paragraph 52.

11 A Wait, are we going 52 of my --

12 Q Of your reply, correct.

13 A Hold on one second. Mm-hmm.

14 Yes, is there a question?

15 Q I was -- you were telling me to hold for a
16 second, so I was just holding.

17 All right. So are you at paragraph 52?

18 A Yes.

19 Q All right. So when modifying Kim, you
20 would apply the heat diffusion step to the
21 impurities implanted in Kim's insulating layer
22 122, correct?

1 A Yes.

2 Q And so you would spread the damaged region
3 in insulating -- auxiliary insulating layer 122,
4 correct?

5 A Yes.

6 Q Okay. Again, we walked through Kim's
7 process earlier. When would you incorporate Nam's
8 heat diffusion process into Kim's process to
9 obtain the curved side surface?

10 A Well, in Kim's, you apply the heat after
11 the ion implantation, which causes the damage to
12 spread and resulting in a curved contact pad, as I
13 explain in paragraph 51 and 52.

14 Q So walking through the Kim process, a mask
15 pattern is formed on auxiliary layer 122, correct?

16 A Yes.

17 Q And then you would modify Kim by then
18 performing this heat diffusion step directly after
19 using the mask pattern. Is that fair to say?

20 ATTORNEY HERMAN: Objection to form.

21 A You do implantation of the damage first.

22 Q So first you would use the mask pattern,

1 and then you would implant the damaged region,
2 fair?

3 A Right.

4 Q And then after you implant the damaged
5 region into layer 122, you would heat that area,
6 is that fair?

7 A Yes.

8 Q And then after you did that, you would
9 form the insulating layer 125, and then you would
10 remove the sacrificial layer 120; is that fair?

11 A Yes. You could do that.

12 Q And then after the sacrificial layers are
13 removed, you would fill those gaps to form the
14 pad. Is that how you would modify Kim in view of
15 Nam?

16 A Yes, it's basically the same process,
17 except now you apply heat to allow it to spread so
18 that it give you the rounded -- rounded corners.
19 And we talk about that normally in my opening
20 declaration, but also, I believe in my last
21 deposition, which, again, this is nothing new, but
22 to -- to help to -- for -- after Giapis, and the

1 patent owner seems to be confused how it works,
2 and this inclusion of the figure and the
3 description is to try to elaborate and clarify the
4 process step for them.

5 Q So let's look at this figure you've
6 reproduced in paragraph 52 of your reply
7 declaration.

8 Are you there?

9 A Yeah.

10 Q Okay. So when a person of ordinary skill
11 in the art modifies Kim to form a curved side
12 surface in view of Nam, it would implant ions into
13 the auxiliary layer 122, correct?

14 A Right.

15 Q Then a person of ordinary skill would heat
16 the auxiliary layer 122, correct?

17 A Yes.

18 Q And by heating the auxiliary layer 122,
19 the impurities of the auxiliary insulating layer
20 122 will spread, correct?

21 A Yes.

22 Q And when the auxiliary layer 122 spreads,

1 where does it spread to?

2 A As shown in my figure, it's spread into
3 the 122, not from the 122_I.

4 Q Would the insulating layer only spread
5 horizontally during this process?

6 ATTORNEY HERMAN: Objection.

7 A Well --

8 THE WITNESS: Sorry, Patrick.

9 A No, it would spread both horizontally and
10 vertically. What's important is the horizontal
11 spreading, not the vertical spreading.

12 Q So using a heat diffusion process in Kim
13 would expand the insulating layer into the etched
14 region where the landing pad is formed, correct?

15 A No. As I describe in paragraph 58, when
16 you implant the damage, you can adjust the profile
17 and -- in such a way that the bottom of the pad is
18 wider and the top of the pad is narrower. So
19 therefore, the wider bottom would prevent contact
20 to punch through when you etch the contact. And
21 the narrower top prevent the shorting between the
22 pads and the adjacent conductive structure. This

1 is all explained in paragraph 58.

2 So you get the best of both worlds, by
3 doing the process that I discuss in my opening
4 report, as well as elaborations in my reply
5 declaration.

6 Q And when you say "you can adjust the
7 profile so that the bottom of the pad is wider and
8 the top of the pad is narrower," where in Nam is
9 that disclosed?

10 A Nam disclosed just implantations, but the
11 person of ordinary skill in the art would
12 understand that implantations could either be --
13 would have both the dosage and the profile. And I
14 believe that -- so a person of ordinary skill in
15 the art would understand that when you do the
16 implant, there will be a damage -- in fact, in
17 figure -- let's see. Yeah, Figure 34 --

18 Q So Doctor, you're referring to Figure 34
19 of Nam?

20 A No. So -- so if you look at, for
21 example -- let me see which figure -- figure -- go
22 to Figure 22.

1 Q Of Nam?

2 A Of Nam. Or even Figure 20. Okay. It
3 talks about, you can have an implantation with
4 a -- basically profiling the damage. And the
5 difference between DA1 and DA2 is DA1 is formed by
6 the first ion implantations, which will give you
7 location near the local -- lower surface of the
8 sacrificial layer in the pad region, representing
9 the damage, with impurity degrade of film
10 characteristics resulting in a higher etch grade.
11 Okay.

12 And then you also can have another
13 implant, DA2, by a second ion implantation, which
14 is formed in the upper surface, and, again, which,
15 causing a higher etch rate and -- so overall --

16 By the way, you don't -- Nam described it
17 in two different separate implant, but you can all
18 done in one single implant with -- with a
19 alternating energy level. And -- so all in one.

20 So therefore, what happened is that now
21 you create the damage at both the upper -- upper
22 surface and a lower surface, and nothing in

1 between, okay? As a result, you would give rise
2 to a shape that -- in figure -- for example,
3 Figure 25, Figure 27, Figure 29.

4 So in other words, Nam would understand
5 that you could profile the implant damage in such
6 a way that it give rise to a etching profile
7 according to what you decide to have.

8 And similarly, in my reply declaration in
9 paragraph 52, that one can profile the implant
10 damage in such a way that you would result a wider
11 bottom compared to the top, as I describe in
12 paragraph 58. And you get the best of both
13 worlds. You have a wide bottom, which prevent a
14 shorting, caused by contact punch-through, and you
15 get a narrower top so that it remained a good
16 distance between the pads and the adjacent contact
17 structure. So therefore, you would avoid and
18 prevent shorting between the pads and the adjacent
19 conductive structure.

20 So that's what I'm discussing and
21 elaborate based on -- again, based on how my
22 discussion in my opening report.

1 Q Let's go to paragraph 59 of your reply
2 declaration.

3 A Okay.

4 Q You say, "Kim is open to various different
5 pad shapes and sizes."

6 Do you see that?

7 A Yes.

8 Q Okay. Kim's pad shapes are not created
9 randomly, though, correct?

10 A Obviously every process is
11 well-controlled. The point that I want to make in
12 paragraph 59 is basically distilled what
13 Dr. Giapis and the patent owner seems to indicate
14 in that the -- in paragraph 57, I said that
15 Dr. Giapis seems to be confused about Kim's
16 reference and say that using Nam's rounding
17 process would basically negate the -- Kim's
18 advantage of precise -- precisely control the
19 location of the landing pad.

20 And I disagree with both points, as I
21 describe in paragraph 57. And that Kim does not
22 say that the pad formation is intended to produce

1 precisely the pad shape.

2 And -- so Dr. Giapis seems to suggest that
3 when you rounded the corner, you will lose all the
4 precision. On the contrary, each process is done
5 with precision and with control and that -- you
6 know, I think he seems to confuse that you
7 might -- it might cause the shape to be the --
8 somehow become uncontrollable and that the pads
9 might be too close and cause shorting.

10 But Kim never used the word "precise,"
11 anywhere in this pad formation that it tends to
12 produce precisely shaped pads. Even though by
13 using the process, the -- as described in
14 paragraph 52, will have -- will have -- will
15 result in a well-controlled process, but it will
16 not create a short between the pads and the
17 adjacent conductive pad, as Dr. Giapis seems to
18 suggest when Nam is used in the process.

19 Q Okay. Let's go to paragraph 62.

20 A Okay.

21 Q You claim that "A person of ordinary skill
22 in the art would have recognized that a rounded

1 landing pad operates to increase the distance
2 between the landing pad and the adjacent
3 conductive structure," correct?

4 A Sure.

5 Q Does --

6 A I do, right. If it is a sharp corner, you
7 know, versus a rounded corner, rounded corner will
8 give you a bigger distance. And furthermore,
9 rounded corner will have less electric field gate
10 intensity.

11 Q Does a landing pad rounded in the x-y
12 plane increase the distance between the landing
13 pad and the adjacent conductive structures?

14 A Would rounded pad in the x-y plane
15 increase the distance between -- yeah, if you
16 round the pad, will -- think about it, if you have
17 a square pad and then you rounded it off, then
18 obviously it will increase the distance between
19 the landing pad and the adjacent conductive layer.

20 Q Let's go down to paragraph 96 of your
21 declaration.

22 A Okay.

1 Q In paragraph 96, you offer this figure
2 from the Plummer reference as an example of the
3 extra silicon atoms present in non-stoichiometric
4 oxide, correct?

5 A Yes.

6 Q And there is an arrow in this figure
7 pointing to an extra atom marked Qf.

8 Do you see that?

9 A Yeah.

10 Q What does the Qf denote?

11 A In general, when you have -- when you have
12 additional silicon atom and you don't, you know,
13 hear -- basically illustrating that you would have
14 -- in general, you have a non-stoichiometric
15 silicon, meaning that -- non-stoichiometric
16 silicon oxide, meaning that you have SiO_x , which x
17 is less than 2 but greater than 1. Okay?

18 So in the -- when you have an extra
19 silicon atom in the silicon oxide matrix -- so
20 ideally, what you have -- ideally, what you like
21 to have is silicon is bonded to oxygen to form a
22 silicon oxide layers and -- but if you have extra

1 silicon or extra dangling bonds, such as
2 showing --

3 (Reporter clarification.)

4 A Dangling bonds. Like if you look to the
5 left of the arrow Qf, you see some bonds that are
6 dangling, okay? And that dangling bond can
7 eventually cause defect. And Qf stands for fixed
8 charge, is one type of charge that basically
9 degrades the performance of the transistors.

10 And -- so what you'd like to have is to
11 have that silicon bond, that's extra silicon, to
12 be bonded to an oxygen. So therefore, the -- what
13 I discuss in -- in the -- in this section is
14 basically that having an oxygen deficiency in the
15 non-stoichiometric oxide, non-stoichiometric
16 silicon oxide, is basically -- would cause a
17 oxidation, not very much, a slight oxidation, not
18 only create such a rounded corner that we discuss,
19 but also repair some of the bonding in perfection
20 in the matrix.

21 Q Is Qf an example of a charged defect in the
22 non-stoichiometric silicon oxide?

1 A No. Q_f is a fixed charge in a non-ideal
2 situation, not only in non-stoichiometric oxide
3 but also even when you have supposedly pure SiO_2
4 or have DM oxide, high-k dielectric. They all
5 would have some imperfection, and one of the
6 imperfection is Q_f .

7 Q And what do you mean by "imperfection"?

8 A "Imperfection" means that when -- when
9 you -- when you operate the transistors and
10 whether it is a logic microprocessor or 3D NAND,
11 the electron tend to float around. And when you
12 have imperfection in the oxide, the electron will
13 be -- easily be tracked, basically tied to this Q_f
14 site.

15 And imagine that the SiO_2 is supposed to
16 be -- or SiO , silicon oxide or silicon dioxide, is
17 not supposed to have any charge in the insulator.
18 Now you have a electron charge, and that would
19 alter the characteristics of the underlying
20 transistor and causing slowdown of the
21 semiconductor chip and degrade the reliability of
22 semiconductor chip.

1 That's what I mean by imperfection.

2 Q So the non-stoichiometric oxide is
3 electrically defective?

4 A No --

5 ATTORNEY HERMAN: Objection. Form.

6 A -- that's not what I said. A
7 non-stoichiometric oxide is not inherently
8 inferior or unstable or more reactive compared to
9 SiO₂. It's simply that it has slightly more
10 silicon compared to pure SiO₂. Si is silicon, O
11 is oxygen and a subscript 2.

12 So whether you have stoichiometric silicon
13 dioxide or non-stoichiometric silicon oxide, that
14 both are -- both happens in ordinary conventional
15 semiconductor processing. You don't need any
16 special process to achieve non-stoichiometric
17 silicon oxide. You don't need to do anything
18 special in the processing. Just like what is
19 described in one of the prior art reference
20 Ohsaki, and both can be very robust insulators.

21 So let me clarify that. I'm not
22 suggesting changing or replacing the insulating

1 material in Kim or Lee for the purpose of the
2 rounding of the pad. A person of ordinary skill
3 in the art would know that the dielectric material
4 being used in semiconductor processing would have
5 some amount of excess silicon, and these excess
6 silicon would enable further oxidization when
7 the -- when the device is exposed to oxygen. And
8 that I discuss in detail in my -- in paragraph 83
9 to 92.

10 Q Let's go down to paragraph 98 of your
11 reply declaration.

12 A 98. Okay.

13 Q You stated, "A person of ordinary skill in
14 the art" -- or POSITA -- would have immediately
15 recognized that it would have been desirable to
16 further oxidize the non-stoichiometric film to
17 reduce the amount of extra silicon."

18 Do you see that?

19 A Right.

20 Q Why would a person of ordinary skill in
21 the art want to further oxidize non-stoichiometric
22 oxide into silicon dioxide?

1 A Well, as I mention, when you have extra
2 silicon as in the -- in the paragraph of 96, where
3 I have included the image, Figure 6-39, that the
4 extra silicon would result in a fixed charge which
5 amounts to some kind of defect. So by oxidizing
6 it, you basically minimize the amount of extra
7 silicon and therefore reduce the -- the material
8 degradation problem and at the same time produce a
9 rounded landing pad.

10 Q So would you say that the
11 non-stoichiometric oxide due to its extra silicon
12 is electrically defective compared to the silicon
13 dioxide?

14 ATTORNEY HERMAN: Objection to form.

15 A No.

16 THE WITNESS: Sorry, Patrick.

17 A No. As I discussed earlier, the
18 non-stoichiometric silicon oxide is not inherently
19 inferior, unstable, or more reactive compared to
20 pure SiO₂.

21 What I'm saying is that the
22 non-stoichiometric silicon oxide obviously have

1 slightly more silicon atoms, okay, excess silicon,
2 and this excess silicon would allow further
3 oxidation when exposed to oxygen. And -- however,
4 this small amount of silicon, excess silicon will
5 potentially give rise to wear-out.

6 Having said that, the pure silicon dioxide
7 also have dangling bonds, which might be
8 passivated with hydrogen atom, but those are not
9 very strong bond, would also cause reliability
10 issues. In other words, silicon dioxide and
11 non-stoichiometric silicon oxide are both, in
12 general, very robust, and depending on the
13 processing, some might be less reliable compared
14 to others.

15 It depends on the detail processing, it
16 depends on whether you densify the oxide
17 afterwards, whether you oxidize -- to further
18 oxidation or annealing. So the detail is quite
19 complicated.

20 But the bottom line is that one cannot say
21 that non-stoichiometric silicon oxide is
22 inherently unstable compared to pure SiO₂.

1 Q To convert the non-stoichiometric oxide
2 into silicon dioxide, that requires an additional
3 processing step, correct?

4 A Well, as I describe, the purpose -- first
5 of all, as I describe -- discussed earlier and
6 also in my reply declarations, as well as during
7 the deposition previously, when we say that,
8 whenever there is an excess amount of silicon,
9 whether it's coming from the silicon substrate or
10 whether it's coming from the fact that you have
11 non-stoichiometric silicon oxide, the amount of
12 excess silicon would allow for further oxidation
13 when exposed to oxygen. And that gave us an
14 ability to rounded the corner of the -- of the
15 contact pad. Okay?

16 So to answer your question, yes. If you
17 want to convert non-stoichiometric silicon oxide
18 to pure silicon oxide, all you have to do is
19 simply do additional oxidation, which someone --
20 some people may call that densifications. But
21 that's a very simple step, and it achieves the
22 best of both worlds, rounded corner and wider pad

1 in the bottom.

2 Q How does silicon dioxide and
3 non-stoichiometric silicon oxide compare in their
4 band gaps?

5 A Well, in general -- as I discuss in my --
6 in paragraph 85 to 86, it is well-known that LPCVD
7 and PECVD oxide would result in non-stoichiometric
8 silicon oxide and [indiscernible] it is SiO_x --

9 (Reporter clarification.)

10 A SiO_x , silicon, S-I, O, oxygen, X. Okay?
11 It's a molecular symbol, silicon O_x , SiO_x .

12 But, in general, that x is closer to 1.7,
13 1.9. So the amount of excess silicon is quite
14 negligible. And pure SiO_2 has a band gap, silicon
15 band gap or energy band gap of about nine electron
16 volt. Okay? And non-stoichiometric silicon oxide
17 has a very similar band gap because the amount of
18 oxygen deficiency is quite small. And -- so the
19 band gap is very similar.

20 Now, of course, you can always find some
21 example that x is very low, like 1.2, 1.1, that
22 would result in a much smaller band gap, but those

1 are outliers.

2 Q But the band gap will be smaller in the
3 non-stoichiometric silicon oxide compared to the
4 silicon dioxide, correct?

5 A That is not correct. Were you listening
6 to me? The SiO_x , where x is closer to 2, 1.7 to
7 1.9, the band gap is not smaller.

8 Q So the band gap increases where the amount
9 of oxygen per silicon atom is 1.7 to 1.9 compared
10 to silicon dioxide. That's your testimony?

11 A I don't think you're listening to me.
12 There is not conventional non-stoichiometric
13 silicon oxide that you see in typical processing
14 in semiconductor chips, including microprocessor,
15 3D NAND. They all include -- naturally include
16 non-stoichiometric silicon oxide. Those have the
17 same amount of band gap.

18 Because if you think about it, the
19 percentage is so small that it is not -- it is not
20 affecting the band gap. If you understand the
21 band gap theory, you would see that the effect is
22 very small, especially when x is very close to

1 two, 1.7, 1.9, and so -- but the -- the advantage
2 of having a smaller x, 1.7, 1.9 versus 2 is that
3 you allowed some amount of excess silicon for
4 further oxidation when exposed to oxygen and which
5 causing a -- a rounded corner of the landing pad,
6 what we try to achieve.

7 Q Dr. Lee, let's go to paragraph --

8 A You're already at the last paragraph, 98.

9 Q We're going to bounce up a little bit.

10 A Oh.

11 Q Let's go and talk about the Lee reference
12 real quick. Let me go put that in the chat.

13 A What paragraph are you talking about?

14 Q We will refer to paragraph 81. Let's
15 start with paragraph 81?

16 A Are you talking about Lee?

17 Q Yes.

18 A 81.

19 Q Now, you offer the opinion that a person
20 of ordinary skill in the art would be motivated to
21 combine Lee with Park's oxidation process,
22 correct?

1 A Yes.

2 Q Okay. Let's turn to paragraph 48 of Lee,
3 which is Exhibit 1007.

4 A Hold on, let me get --
5 Okay.

6 Q In paragraph 48, it states -- and this is
7 the second part --

8 A Paragraph 48 of Lee or paragraph --

9 Q Lee, paragraph 48 of Lee.

10 A Hold on one second. Okay, I'm there.

11 Q Okay. Lee states that "before an impurity
12 implantation process is performed, side walls of
13 the first material layers 21 exposed at respective
14 steps may be oxidized to thereby form a plurality
15 of barrier layers 28."

16 Did I read that correctly?

17 A I think so.

18 Q So from Lee, layer 21 is oxidized to form
19 barrier layer 28, correct?

20 A Hold on. This is Figure 8A.

21 Q 8B is this one.

22 A Sorry, let me go there.

1 So what's your question?

2 Q Sure. In Lee, layer 21 is oxidized to
3 form barrier layers 28, correct?

4 A Barrier -- okay. Yeah.

5 Q So you're with me right now, right?

6 In Lee, layer 21 is oxidized to form
7 barrier layer 28, correct?

8 A That's what he says there.

9 Q But layer 22 is never described as being
10 oxidized in Lee, correct?

11 A So layer 21 is the sacrificial layer,
12 right? Layer 22 is the insulating layer.

13 Q So Lee never describes oxidizing layer 22,
14 correct?

15 A Sorry, it's getting late and -- I believe
16 you're correct. Lee does not oxidize layer 22.

17 Q If oxidation in Lee occurred on the edge
18 of the staircase, would layer 22 be oxidized?

19 ATTORNEY HERMAN: Objection. Form.

20 A Well, it depends on the state of layer 22,
21 but layer 22 is deposited as an oxide. So -- a
22 silicon dioxide. So at least the purpose of

1 the -- of the process is that that layer is not
2 subject to any subsequent oxidations.

3 Q So layers 22 is not subject to any
4 subsequent oxidation, correct?

5 ATTORNEY HERMAN: Objection. Form.

6 A You're right. It's not -- in general,
7 even if it is exposed to even -- it might oxidize
8 slightly but not very much. At least it's not
9 designed to oxidize.

10 Q If layer 22 were able to be oxidized at
11 the end of the staircase, these pads would be
12 shortened. Is that fair to say?

13 ATTORNEY HERMAN: Objection. Form.

14 A Again, it's not designed to be oxidized.

15 Q And that's because layer 22 is made of
16 silicon dioxide; is that fair?

17 ATTORNEY HERMAN: Objection. Form. It
18 misstates the witness's testimony.

19 Q Dr. Lee, did you hear my question?

20 A No, I did not.

21 Q Is layer 22 made of silicon dioxide?

22 ATTORNEY HERMAN: Objection. Form.

1 A 22 or 21?

2 Q 22. Do you need me to restate the
3 question, Dr. Lee?

4 A No. I'm -- you're asking whether layer 22
5 in Figure 8B is made of silicon dioxide?

6 Q Correct.

7 A Hold on. Sorry.

8 ATTORNEY HERMAN: While he's looking at
9 that, how long have we been on the record?

10 ATTORNEY WATSON: Honestly, this is my
11 last question, Patrick, assuming he confirms what
12 he's already said. I've just been waiting for it
13 for ten minutes.

14 A Oh, in paragraph 30, it says that second
15 material layer may include insulating layer such
16 as oxide layer. So it seems like it is an oxide
17 layer but -- but not necessarily silicon dioxide.

18 ATTORNEY WATSON: I don't have any further
19 questions, subject to, of course, what your
20 counsel asks.

21 EXAMINATION BY

22 ATTORNEY HERMAN:

1 Q I just have two or three questions,
2 Dr. Lee.

3 The first is, is it your understanding
4 that the deposition today was meant to be a memory
5 test?

6 ATTORNEY WATSON: Objection.
7 Argumentative.

8 A I don't -- I hope it is -- I don't know,
9 but it seems like it is asking questions -- asking
10 for my memory test.

11 Q Did you memorize your declaration in
12 preparation for today's deposition?

13 A No.

14 ATTORNEY WATSON: Same objection.

15 Q So, for instance, counsel asked you today
16 if, in Lee, layer 22 is meant to be silicon
17 dioxide. Do you remember when he asked that
18 question?

19 A Yes.

20 ATTORNEY WATSON: Objection. Form.

21 Q When he asked that question, did he direct
22 you to paragraph 81 of your reply declaration?

1 A No, he did not.

2 Q What does paragraph 81 of your reply
3 declaration say?

4 ATTORNEY WATSON: Objection. Form.

5 A That Lee explained that insulating layer a
6 form of oxide, not solid silicon dioxide.

7 Q Would that have answered counsel's
8 question?

9 A Yes. So that's the answer to Mr. Watson's
10 question.

11 Q And is that still your opinion today?

12 A Yes, it is.

13 Q And counsel also asked you if layer 22 in
14 Lee is capable of being further oxidized. Do you
15 remember that question?

16 ATTORNEY WATSON: Objection. Form.

17 A Yes.

18 Q In asking you that question, did counsel
19 direct you to paragraph 89 of your reply
20 declaration?

21 ATTORNEY WATSON: Objection. Form.
22 Leading.

1 A I can't recall that, yes. I don't know if
2 he did or not. I don't remember.

3 Q In paragraph 89 of your declaration, you
4 include a figure that shows oxide layer 22 being
5 further oxidized.

6 A Yes.

7 ATTORNEY WATSON: Objection. Form.
8 Leading.

9 Q Did counsel direct you to that figure when
10 asking you that question about the further
11 oxidation of layer 22?

12 ATTORNEY WATSON: Objection. Form.
13 Leading.

14 Counsel --

15 A In the earlier --

16 ATTORNEY WATSON: -- you can ask yes-or-no
17 questions.

18 A In the earlier discussion but not in the
19 later discussion.

20 ATTORNEY HERMAN: I have no further
21 questions.

22 ATTORNEY WATSON: All right.

1 CONTINUED EXAMINATION BY

2 ATTORNEY WATSON:

3 Q Dr. Lee, during your deposition, did --
4 you were asked in this cross-examination about
5 certain paragraphs of your reply declaration.
6 Do you remember that?

7 A Yes.

8 Q Okay. And when you answered the questions
9 throughout this deposition, did you answer it to
10 the best of your ability?

11 A Yes.

12 Q Okay.

13 ATTORNEY WATSON: I don't have any further
14 questions.

15 ATTORNEY HERMAN: Let's see here. Thank
16 you, Dr. Lee, and thanks --

17 ATTORNEY WATSON: I do want to reserve the
18 right to object based on the transcript for
19 nonresponsive answers, but we can take a look at
20 that and see afterwards.

21 ATTORNEY HERMAN: Again, I disagree that's
22 an option that's available for you, but you can do

1 whatever you like.

2 ATTORNEY WATSON: Your counsel -- you guys
3 have done it multiple times, so I think that's it
4 for us.

5 (Time noted: 4:28 P.M.)

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ACKNOWLEDGMENT OF DEPONENT

I, JACK LEE, Ph.D., do hereby acknowledge
that I have read and examined the foregoing
testimony and the same is a true, correct, and
complete transcription of the testimony given by
me and any corrections appear on the attached
errata sheet signed by me.

(SIGNATURE)

(DATE)

1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2 I, Anita M. Trombetta, Certified Reporter and
3 Notary Public within and for the State of New York
4 Do hereby certify: That JACK LEE, Ph.D., the
5 Witness whose deposition is hereinbefore set
6 forth, was duly sworn by me before the
7 commencement of such deposition and that such
8 deposition was taken before me and is a true
9 record of the testimony given by such
10 Witness.

11 I further certify that the adverse party,
12 MICRON TECHNOLOGY, INC., was represented by
13 counsel at the deposition.

14 I further certify that the deposition of
15 JACK C. LEE, Ph.D., occurred remotely via Zoom
16 on Tuesday, December 23rd, 2025 at
17 9:01 A.M. to 4:28 P.M. Central Time.

18 I further certify that I am not related to
19 any of the parties to this action by blood or
20 marriage, I am not employed by or an attorney to
21 any of the parties to this action, and that I am
22 in no way interested, financially or otherwise, in
the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my
Hand this 29th day of December, 2025.



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A			
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Transcript of Jack C. Lee, Ph.D.
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