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

WESTERN DIGITAL TECHNOLOGIES, INC.,	)	
Petitioner,	)	
vs.	)	Case No. IPR2024-01493
GODO KAISHA IP BRIDGE 1,	)	IPR2024-01447
Patent Owner.	)	

REMOTE DEPOSITION OF
JEFFREY BOKOR, PH.D.
OCTOBER 30, 2025

Reported by:
Brooke Silvas, CSR 10988
Job No. 1423370

MAGNA LEGAL SERVICES

IP Bridge Exhibit 2085
Western Digital v. IP Bridge
IPR2024-01494

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2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
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4 WESTERN DIGITAL TECHNOLOGIES, INC.,)
)
5 Petitioner,)
)
6 vs.) Case No.
) IPR2024-01493
7 GODO KAISHA IP BRIDGE 1,) IPR2024-01447
)
8 Patent Owner.)
_____)
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12
13 Deposition of JEFFREY BOKOR, PH.D.,
14 taken remotely via Zoom, commencing at
15 9:02 a.m., on Thursday, October 30, 2025,
16 before Brooke Silvas, Certified Shorthand
17 Reporter No. 10988.
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22
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1 I N D E X

2 WITNESS: JEFFREY BOKOR, PH.D.

3 EXAMINATION BY PAGE

4 ATTORNEY WICHMAN 5

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8 E X H I B I T S

9 BOKOR DESCRIPTION PAGE

10 2079 United States Patent and Trademark 55

Office - Application 10/824,835

11 Notice of Abandonment

12

13

14

15 INSTRUCTION NOT TO ANSWER

16 (None)

17

18

19 INFORMATION TO BE SUPPLIED

20 (None)

21

22

23

24

25

1 REMOTE DEPOSITION; OCTOBER 30, 2025
2 9:02 A.M.
3
4 JEFFREY BOKOR, PH.D.,
5 having been duly administered an
6 oath remotely by the reporter, was examined
7 and testified as follows:
8
9 EXAMINATION
10 BY ATTORNEY WICHMAN:
11 Q Dr. Bokor, good morning. Where are you
12 located today?
13 A Offices of Armond Wilson in Newport
14 Beach.
15 Q Do you have access to exhibits in a PDF
16 form for today's deposition?
17 A Okay. Let me make sure I've got that. I
18 had it a second ago.
19 Okay. Let's minimize that. Let's
20 minimize that. There it is.
21 Okay. I have the access to the documents
22 in PDF form.
23 Q Do you have the chat for this Zoom call
24 open on your desktop or laptop?
25 A I don't think I do. Do you want me to

1 open that?
2 Q Yes, please.
3 A Okay.
4 Q Do you see a document titled Paper Number
5 27?
6 A Did you get me?
7 Q I do. If you scroll up, do you see a PDF
8 titled with Paper Number 27?
9 A I do not.
10 Q Let me try sending it again.
11 A You know, if you sent it before I joined,
12 it won't be in the chat.
13 Q Okay. Do you see Paper 27?
14 A I do. You want me to open that?
15 Q Open that, please.
16 A I'm going to click the download button
17 first, it looks like. Okay. Save it in
18 documents. I've got to go to documents. There it
19 is. One moment. I've got to make sure that I
20 don't lose this directory. Please bear with me.
21 Okay. I now have Paper Number 27 open on
22 my screen.
23 Q Do you see the first page is titled
24 Patent Owner's Notice of Deposition of Jeffrey
25 Bokor, Ph.D.?

1 A Yes.
2 Q Do you see that this is in case number
3 IPR2024-1493?
4 A Yes.
5 Q Do you see this concerns patent number
6 10,680,167?
7 A Yes.
8 Q Okay. We will refer to that as the '167
9 patent. Okay?
10 A Okay.
11 Q If you look at the second page, do you
12 see that this deposition concerns two cases,
13 IPR2024-01447 and IPR2024-01493?
14 A I see that.
15 Q All right. If you go to the chat now, do
16 you see Paper Number 28?
17 A I do.
18 Q Open that, please.
19 A Okay. First I have to download it. It
20 went to Documents. Where did I put Documents?
21 There it is.
22 Okay. I have that file open on my screen
23 now.
24 Q Do you see that Paper Number 28 is a
25 notice of deposition in case number IPR2024-01447?

1 A I see that.
2 Q And this case concerns patent number
3 8,405,134; right?
4 A Right.
5 Q All right. In the exhibit PDFs that
6 you have on your computer, are they sorted into
7 files for the case -- different cases 01447 and
8 01493?
9 A They are.
10 Q Okay. And then within those folders, you
11 have exhibits for those cases; is that right?
12 A That is correct.
13 Q All right. So, Dr. Bokor, you submitted
14 a reply declaration in case 01447 on the '134
15 patent; is that correct?
16 A Yes.
17 Q And you submitted a reply declaration in
18 case 01493 on the '167 patent; is that right?
19 A Correct.
20 Q And, in fact, you submitted -- it is the
21 same document that you submitted in both cases; is
22 that right?
23 A Correct.
24 Q How much time did you spend preparing
25 that reply declaration?

1 A Oh, I can't remember. That was a while
2 back. I really don't have any estimate of how
3 much time I spent on that. It could have been --
4 probably more than ten hours.
5 Q Dr. Bokor, the 1493 case, I would like
6 you to open Exhibit 1105.
7 A 1493?
8 Q Yes.
9 A Okay. 1015.
10 Q Exhibit 1105, this is your reply
11 declaration.
12 A Sorry. There's a lot of documents in
13 here. 1105. You want me to open that?
14 Q I do. Is it open?
15 A Yes.
16 Q Could you go to the last page of that
17 document, please.
18 A I see that. Yes. I'm on the last page.
19 Q Is that your signature, Jeffrey Bokor?
20 A It is.
21 Q You signed this declaration on
22 October 8th; is that right?
23 A Correct.
24 Q And today is October 30th?
25 A It is.

1 Q And you can't remember how much time you
2 spent preparing this declaration because it was
3 too long ago? Is that your testimony?
4 A I -- I'll say yes. I did not review my
5 invoices for the work that I did leading up to
6 this. And I don't have a specific recollection of
7 how many hours I billed in the work I did leading
8 up to the submission of this declaration.
9 Q When did you start preparing this reply
10 declaration?
11 A Well, to the best of my recollection, it
12 would have been shortly after the deposition of
13 Dr. Ross. I can't remember exactly what the date
14 was on that, but you probably have it. So
15 somewhere around -- around that time, shortly
16 after that.
17 Q And how many -- did you work on it
18 continuously since seeing the deposition of
19 Dr. Ross?
20 A I'm not sure what you mean by
21 continuously. 24 hours a day since that time, of
22 course not. Eight hours a day since that time,
23 no. I don't recall off -- offhand how many hours
24 I spent from the time that I first started work on
25 this -- shortly after Dr. Ross' deposition. And

1 October 8th. I don't recall exactly how many
2 hours I spent.
3 Q Did you spend more than ten hours?
4 A I think I probably spent more than ten
5 and less than a hundred.
6 Q Less than a hundred. Did you spend more
7 than 20 hours?
8 A I can't recall.
9 Q Is it --
10 A I don't have access -- right in front of
11 me accesses. I do submit monthly invoices. I
12 don't have them here in front of me. That's what
13 I would refer to to be able to answer your
14 question. And I don't have them. And no, I don't
15 recall specifically what the number was, whether
16 it was 20 or -- or -- certainly more than 10. 20,
17 30, 40, 50, I just don't know.
18 Q Did you spend a hundred hours?
19 A I doubt it. I don't think so.
20 Q But you tried to be thorough when you
21 prepared this reply declaration; right?
22 A Certainly.
23 Q And you wrote it yourself; is that right?
24 A I wrote it with assistance from counsel.
25 Q Which counsel assisted you?

1 A Well, I worked together with Mr. Wilson,
2 Monica Arnold, Spencer Ririe, I believe is the way
3 it is pronounced. A little with Michelle Armond,
4 but not much.
5 Q What did you do to prepare for deposition
6 today?
7 A I met with counsel to discuss -- for the
8 past two days, I've been meeting with counsel.
9 Q How many hours did you spend in the past
10 two days preparing for this deposition?
11 A Well, not counting my travel hours to
12 come here from my home in the San Francisco Bay
13 Area, maybe somewhere around 15 to 20, two days,
14 yeah.
15 Q What --
16 A Two days.
17 Q What counsel did you work with in
18 preparing for this deposition?
19 A Wilson, Arnold, Ririe, and Armond.
20 Q Okay. Dr. Bokor, I want to stay with the
21 folder on the 1493 case, the one that you're in
22 right now. And I would like you to open exhibits
23 2005.
24 A 2005.
25 Q And if you could keep your reply

1 declaration open as well, we will refer to that.
2 A You're talking about -- okay. I have it.
3 Q This is a paper titled Magnetic Tunnel
4 Junctions by Jian-Gang Zhu and Chando Park; is
5 that right?
6 A Right.
7 Q And you have read this paper; right?
8 A Yes.
9 Q Okay. And in your declaration, on the
10 '167 patent, if you could go to paragraph 35,
11 please.
12 A So it is the one declaration for '143 and
13 '167. Yeah?
14 Q Can you go to paragraph 35.
15 A Paragraph 35.
16 Q It is PDF page 34. Are you there?
17 A I'm there.
18 Q Okay. And here refer to Dr. Ross opining
19 on this -- you call it the Zhu/Park Exhibit 2005
20 reference; right?
21 A Yes.
22 Q In Park -- well, if I -- if I -- I'm
23 going to refer to Exhibit 2005 as Park. Okay?
24 A Okay.
25 Q All right. If you look on page 36, which

1 is the first page, PDF 1, this paper was published
2 in November of 2006; is that right?
3 A I see that.
4 Q Is that a yes?
5 A Yes.
6 Q Okay. And it was published in Materials
7 Today?
8 A That's what it says on the page.
9 Q Do you dispute this is an article from
10 Materials Today?
11 A No. I don't dispute it. I don't know
12 that journal. So I don't know. But it says
13 Materials Today. And I have no -- no reason to
14 doubt that it appeared in a journal named
15 Materials Today.
16 Q Do you see the second author is Chando
17 Park?
18 A Yes.
19 Q And footnote 2 gives his affiliation,
20 Chando Park's affiliation as Western Digital
21 Corporation. Do you see that?
22 A I do.
23 Q So Chando Park was with Western Digital
24 Corporation when he wrote this paper; is that
25 right?

1 A That would -- presumably.
2 Q All right. Can you turn to page 39 of
3 Park, Exhibit 2005. On the bottom right, under
4 header "MTJs with crystalline MgO barrier layers."
5 Do you see that?
6 A Yes.
7 Q It is PDF page 4. Okay. Are you there?
8 A Yes.
9 Q All right. Do you see that Park writes,
10 "Achieving a high TMR ratio in MgO-based MTJs
11 requires correct crystalline orientation of the
12 ferromagnetic electrodes, which are either bcc
13 cobalt, bcc iron, or an alloy of the two, and
14 lattice matching at the interfaces between the
15 electrodes and the tunnel barrier." Right? Do
16 you see that?
17 A Yes.
18 Q And do you agree that was true in 2004?
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: I'll agree with that.
21 You're saying as of 2004; correct?
22 BY ATTORNEY WICHMAN:
23 Q You agree this statement was true in the
24 art in 2004?
25 ATTORNEY ARNOLD: Objection. Form.

1 THE WITNESS: Yes.
2 BY ATTORNEY WICHMAN:
3 Q The next sentence, "However, it has
4 proven difficult to grow bcc cobalt or bcc iron
5 with 001 texture directly by any practical
6 physical vapor deposition technique without a
7 single crystal substrate (the use of which would
8 vastly limit commercial applications)." Did I
9 read that correctly?
10 A You read it correctly.
11 Q You agree that that statement was -- a
12 POSA would have regarded that statement as true in
13 2004?
14 ATTORNEY ARNOLD: Objection. Form.
15 THE WITNESS: I would say that statement
16 is arguable.
17 BY ATTORNEY WICHMAN:
18 Q And why is that?
19 A Because that -- oh, hold on. Let me --
20 let me reconsider. Now, that -- that I agree
21 with.
22 Q Next sentence, "The development of
23 CoFeB/magnesium oxide/CoFeB tunnel junctions by
24 Anelva provides a practical solution to overcome
25 this difficulty." Did I read that correctly?

1 A Yes. Let me just clarify just for the
2 record. When you say CoFeB, what it says in the
3 article -- and this is true throughout the art, so
4 I just want to get this clarified for the record
5 at this -- at the outset. The -- what you have
6 referred to there is CoFeB. The correct chemical
7 description there is cobalt iron boron. That's a
8 description of an alloy of cobalt, iron, and
9 boron. And in the art, myself included, we
10 frequently refer to that with the shortcut or
11 shorthand CoFeB. It is a cute little nickname for
12 this alloy. When you say CoFeB, you're referring
13 to the cobalt iron boron alloy. I'm familiar with
14 that. I do it myself all the time. But it's --
15 it's a slang, if you like. It is sort of -- it is
16 sort of a shorthand. So I just wanted to state at
17 the outset for the record, that's what we mean
18 when we say CoFeB.
19 Q Do you recall the question that I just
20 asked you?
21 A I think you asked me whether that's what
22 it said. But why don't you --
23 Q The question was whether I read it
24 correctly?
25 A Yeah. Whether you read it correctly.

1 And that's -- thank you. And that's what I was
2 answering. You read it correctly, in light of the
3 commonly used slang for cobalt iron boron, which
4 is widely used by practitioners in this art.
5 Thank you for refreshing my memory on exactly what
6 the question was.
7 Q Dr. Bokor --
8 A That's why I answered it that way.
9 Q Dr. Bokor, do you see there's an and note
10 reference to 21 appended to Anelva in that
11 sentence?
12 A Yes.
13 Q All right. If you'll turn to page 45,
14 which is your PDF 10. Those are the references;
15 correct?
16 A I see that.
17 Q And reference 21 is a paper by -- I'm
18 going to pronounce it Djayaprawira, Applied
19 Physics Letter 2005, Volume 86; is that right?
20 A Yes.
21 Q And we've been referring to that paper in
22 this case as Yuasa APL 2005; right?
23 A I believe so.
24 Q In fact, if you look at Exhibit 2006 in
25 this case, that -- that is the Yuasa APL 2005

1 paper; right?
2 Yes?
3 A I just need a moment.
4 Q Okay.
5 A Where did my -- I've got a lot of windows
6 open. 2006 is that paper. Exhibit 2006 is the
7 Djaya -- Djayaprawira 2005 APL article.
8 Q So when Park here, Exhibit 2005, refers
9 to Anelva reference 21, that's a reference to what
10 we have in the record as Exhibit 2006, Yuasa's
11 2005 APL paper; right?
12 A I'm going to ask for your indulgence.
13 Since I scrolled down to the reference section, I
14 lost my place where we were looking at reference
15 21. What page was that?
16 Q Page 45. It is the last page of
17 Exhibit 2005?
18 A No. That's the reference list. Now I
19 want to go back to where reference 21 is cited.
20 Q Page 39. It is PDF page 4, bottom right
21 column.
22 A Thank you.
23 Q The first sentence of the bottom
24 paragraph.
25 A Yeah. So it says Anelva refers to 21,

1 which is the paper that we were just looking at.
2 That's what -- the first author, Djayaprawira.
3 Q We've been calling that Yuasa 2005 APL or
4 APL 2005; right?
5 A Yes.
6 Q Okay. Next sentence, "In this
7 technique" -- let's just stop there. The first
8 three words are "in this technique"; right?
9 A Yes.
10 Q You agree when Park says "in this
11 technique," Park is referring to reference 21,
12 Yuasa's APL 2005 paper?
13 A Presumably.
14 Q Do you read it differently?
15 A That I think is a fair presumption.
16 Q Okay. Let's go on. "In this technique,
17 a, parenthesis, cobalt iron sub 80, boron sub 20,
18 magnesium oxide, and then, in parenthesis, cobalt
19 iron sub 80, boron sub 20, multilayer is deposited
20 using conventional sputtering." Right?
21 A You read it correctly.
22 Q And then the next sentence refers to
23 20 percent boron contents. So the sub 20 in that
24 chemical equation refers to 20 percent boron in
25 that layer; is that right?

1 A That would be conventional -- that would
2 be the conventional interpretation, yes.
3 Q Okay. So when those two -- okay. When
4 the CoFeB layers on either side of magnesium oxide
5 are deposited, the as-deposited film layer is
6 amorphous in nature; is that right?
7 A That's what the -- that's what the next
8 sentence says, yes.
9 Q Okay. So it's -- it's a three-layer
10 sandwich. So a CoFeB layer is deposited,
11 magnesium oxide layer is deposited, and a CoFeB
12 layer is deposited on top of that; right?
13 A Presumably.
14 Q Do you read it differently?
15 A I don't -- the details, you know, are
16 provided in reference 21. The sequence and what
17 happens in between and so forth, I would have to
18 go back and review the original reference to -- to
19 answer that question in detail. Each of those
20 layers is deposited, according to the sentence, by
21 conventional sputtering.
22 Q Next sentence --
23 A Go ahead.
24 Q -- "A thin magnesium oxide layer grown on
25 top of an amorphous CoFeB layer can readily

1 achieve a well-oriented 001 texture." Correct?
2 A That's what it says, correct.
3 Q And then, "post-annealing of the film
4 stack at temperatures around 360 Celsius induces
5 crystallization of the two CoFeB layers."
6 Correct?
7 A That's a correct reading.
8 Q And the crystallization occurs
9 epitaxially from the two magnesium oxide
10 interfaces. Right?
11 A Right.
12 Q And the two magnesium oxide interfaces
13 meets the top and bottom of the magnesium oxide
14 layer; right?
15 A The top of -- bottom of the magnesium
16 oxide interface with the two CoFeB layers on top
17 and bottom, yes.
18 Q The then Park says, "In this way, the
19 crystallized CoFeB at the barrier interfaces can
20 have a bcc structure well matched with the
21 magnesium oxide lattice," citing Figure 9. Is
22 that right?
23 A That's right.
24 Q And then if you look above this, the last
25 part of that sentence, on page 40 of Exhibit 2005,

1 you will find Figure 9; correct?
2 A Correct.
3 Q And Figure 9 is a TEM, Transmission
4 Electron Micrograph, image of CoFeB/magnesium
5 oxide/CoFeB magneto-tunnel junction deposited
6 using the sputtering technique followed by
7 post-anneal; correct?
8 A That's what it says.
9 Q And if you look in Figure 9, you can see
10 the magnesium oxide 001 layer shows up in white.
11 It is labeled with sort of a magenta text. Is
12 that right?
13 A Right.
14 Q And the -- the top of that layer from the
15 orientation of this picture, or this TEM image, is
16 labeled with the crystallization at the interface
17 with the upper CoFeB layer; is that right?
18 A I agree.
19 Q Okay. And in the caption of Figure 9,
20 again, Park says, "The as-deposited CoFeB is
21 purely amorphous." Right?
22 A That's what it says.
23 Q Then after the annealing process, the two
24 CoFeB layers form a bcc crystalline structure
25 epitaxially for the interface with the magnesium

1 oxide lattice; correct?
2 A That's what it says.
3 Q All right. So you agree that crystalline
4 interface -- the crystallization of the CoFeB at
5 the interface with the magnesium oxide is
6 important for these MTJs to perform well; is
7 that right?
8 A That's a fair statement.
9 Q And you agree that the post-annealing
10 step that Park is describing here is done
11 specifically to induce crystallization of each
12 CoFeB layer; is that right?
13 A At least. Maybe other purposes for that
14 annealing step as well. But it is used to do that
15 crystallization.
16 Q Okay. And if you could open Exhibit
17 1062. This is Parkin.
18 A Okay. I have Parkin.
19 Q Okay. If you go to -- I'm sorry. You're
20 familiar with Parkin?
21 A Generally. Generally, yes.
22 Q You have given extensive testimony on
23 Parkin; correct?
24 A Yes.
25 Q And you have reviewed Parkin in its

1 entirety; correct?
2 A Yes.
3 Q So when you are providing opinions on
4 what Parkin discloses, it is based on your
5 thorough review of Parkin; correct?
6 A Yes.
7 Q Okay. If you could go to column 11
8 please at PDF26. Left-hand side. Let me know
9 when you're there.
10 A Column 11.
11 Q Okay. If you go to line 49, please.
12 A I'm there.
13 Q Okay. So line 49, the sentence at the
14 end of line 49 is, "Experimentally, it is clear
15 that the magnitude of the TMR is extremely
16 sensitive to the nature of the interface between
17 the tunneling barrier and the ferromagnetic
18 electrode." Is that right?
19 A That's what it says.
20 Q If you go back now to Exhibit 2005,
21 Figure 9, the interface between the tunneling
22 barrier and the ferromagnetic electrode is that
23 interface between the magnesium oxide barrier and
24 the CoFeB at either side; right?
25 A That's -- could you please repeat that

1 question?
2 Q All right. If you have Exhibit 2005 in
3 front of you, page 40, Figure 9. We were just
4 discussing that; right?
5 A Yes, I have it.
6 Q Okay. So if you look at Figure 9, it
7 shows a TEM image of CoFeB/magnesium oxide/CoFeB
8 MTJ; right?
9 A Right.
10 Q And the magnesium oxide 001 is the
11 tunneling barrier; right?
12 A That's right.
13 Q And the CoFeB layers on either side of
14 magnesium oxide are what Parkin describes as a
15 ferromagnetic electrode; is that right?
16 A Correct.
17 Q So the interface between the CoFeB and
18 the magnesium oxide is the interface that Parkin
19 is referring to when Parkin says the interface
20 between the tunneling barrier and the
21 ferromagnetic electrode; right?
22 A That's fair, yes.
23 Q And as we just discussed, the -- Park
24 describes Yuasa post-annealing this
25 CoFeB/MgO/CoFeB stack to achieve induced

1 crystallization of the two CoFeB layers; right?
2 ATTORNEY ARNOLD: Objection. Form.
3 THE WITNESS: So this Park reference,
4 Exhibit 2005, describes a process in which the
5 crystallized -- I'm reading now -- the
6 crystallized CoFeB -- I'm reading PDF page 5,
7 right -- right below the figure that we've been
8 discussing. It says, "The crystallized CoFeB at
9 the barrier interfaces can have a bcc structure
10 well matched to the MgO lattice, Figure 9." I
11 believe that's what you were just describing.
12 BY ATTORNEY WICHMAN:
13 Q In Figure 9, there are these two arrows
14 labeled crystallization at the interface; right?
15 A Yes.
16 Q So that's the same interface that Parkin
17 is describing in the sentence that we just read at
18 column 11, lines 49 to 52; correct?
19 A I think what is shown in Figure 9
20 illustrates an example of what Parkin is talking
21 about.
22 Q In Parkin, if we stay in column 11 now,
23 if you go down to line 64.
24 A I'm there.
25 ATTORNEY ARNOLD: Objection. Scope.

1 BY ATTORNEY WICHMAN:
2 Q You see it says, "The tunneling matrix
3 element is determined by the detailed electronic
4 structure of the ferromagnetic, the tunnel
5 barrier, and that of the interface between the
6 ferromagnetic barrier and the electrode." Right?
7 A You read it correctly.
8 Q Do you agree with that statement?
9 ATTORNEY ARNOLD: Objection. Scope.
10 THE WITNESS: I have no reason to
11 disagree with that statement.
12 BY ATTORNEY WICHMAN:
13 Q Do you agree with it?
14 ATTORNEY ARNOLD: Objection. Scope.
15 THE WITNESS: I generally agree with
16 that, yes.
17 BY ATTORNEY WICHMAN:
18 Q Would a POSA have agreed with that in
19 2012?
20 ATTORNEY ARNOLD: Objection. Scope.
21 THE WITNESS: I would say yes.
22 BY ATTORNEY WICHMAN:
23 Q Okay. If you go back to Park,
24 Exhibit 2005, page 39, which is PDF 4, the
25 sentence, "The development of CoFeB/magnesium

1 oxide/CoFeB tunnel junctions by Anelva provides a
2 practical solution to overcome this difficulty."
3 Do you see that?
4 A Bear with me. You said which page
5 number?
6 Q Page 39, PDF 4. The right-hand column,
7 the last paragraph.
8 A Page 39. Back to page 39. Back to page
9 39. I'm sorry. So go ahead and point me to the
10 excerpt on page 39. Right-hand side, you said.
11 Q Are you on page 39 of Exhibit 2005?
12 A Yes.
13 Q Okay. The right-hand column.
14 A I'm there.
15 Q Last paragraph.
16 A The one we've been discussing, yes.
17 Q All right. You agree that that describes
18 a method of manufacturing magnetic tunneling
19 junction device?
20 A Yes, I agree with that.
21 Q Okay. You agree that this paragraph
22 describes forming a first CoFeB layer that is
23 amorphous?
24 A Yes.
25 Q You agree that this paragraph describes

1 forming a second CoFeB layer that is amorphous?
2 A Yes.
3 Q Do you agree that the sentence a thin
4 magnesium oxide layer grown on top of an amorphous
5 CoFeB layer describes forming a magnesium oxide
6 layer over the first CoFeB layer?
7 A Yes.
8 Q And you agree that the second CoFeB layer
9 described in this paragraph is amorphous and
10 formed over the magnesium oxide layer?
11 A Yes.
12 Q Do you agree that this passage describes
13 annealing that the -- I'm sorry. Strike that.
14 Do you agree that the sentence
15 post-annealing of the film stack describes
16 annealing first and second CoFeB layers and the
17 magnesium oxide layer?
18 ATTORNEY ARNOLD: Objection. Form.
19 THE WITNESS: Yes.
20 BY ATTORNEY WICHMAN:
21 Q Do you agree that the sentence
22 post-annealing of the film stack at temperatures
23 around 360 Celsius induces crystallization of the
24 two CoFeB layers describes the first and second
25 CoFeB layers that are crystallized by the

1 annealing?
2 A Yes.
3 Q In Figure 9, in the caption of Figure 9,
4 do you agree that the statement the directly
5 deposited MgO layer clearly shows a well-oriented
6 001 texture describes an MgO layer as
7 polycrystalline in which the 001 crystal plane is
8 preferentially oriented?
9 ATTORNEY ARNOLD: Objection. Form.
10 THE WITNESS: Yes, I think that's what it
11 is referring to.
12 BY ATTORNEY WICHMAN:
13 Q Okay. If we go back to page 39,
14 right-hand column, bottom paragraph, first
15 sentence, where it says, "The development of
16 CoFeB/magnesium oxide/CoFeB tunnel junctions by
17 Anelva, reference 21, provides a practical
18 solution to overcome the difficulty described in
19 the previous paragraph of growing bcc cobalt or
20 bcc iron with 001 texture directly by any
21 practical physical vapor deposition technique
22 without a single crystal substrate."
23 ATTORNEY ARNOLD: Objection. Form.
24 THE WITNESS: Okay. That was a bit long.
25 I'm going to ask --

1 BY ATTORNEY WICHMAN:
2 Q Okay. Let's break it up.
3 We talked about the first paragraph under
4 the header MTJs with Crystalline MgO Barrier
5 Layers; right?
6 A Right.
7 Q And the second sentence of that paragraph
8 refers to difficulty growing bcc cobalt or bcc
9 iron with 001 texture directly by any physical
10 vapor deposition technique without a single
11 crystal substrate; right?
12 A Right.
13 Q And you would -- you agree that a POSA
14 would have agreed with that statement in 2004;
15 right?
16 ATTORNEY ARNOLD: Objection. Form.
17 THE WITNESS: Correct.
18 BY ATTORNEY WICHMAN:
19 Q And you agree that in 2004, a POSA would
20 have understood that using a single crystal
21 substrate would vastly limit commercial
22 allocations of MTGs -- MTJs grown in this
23 fashion; right?
24 ATTORNEY ARNOLD: Objection. Form.
25 THE WITNESS: I agree with that.

1 BY ATTORNEY WICHMAN:
2 Q And you agree that Yuasa in the Applied
3 Physics Letter 2005, described here as Anelva
4 reference 21, provided a practical solution to
5 overcome that difficulty?
6 ATTORNEY ARNOLD: Objection. Form.
7 THE WITNESS: That's fair.
8 BY ATTORNEY WICHMAN:
9 Q And a POSA also would have agreed with
10 that statement?
11 ATTORNEY ARNOLD: Objection. Form.
12 BY ATTORNEY WICHMAN:
13 Q In 2004; is that right?
14 ATTORNEY ARNOLD: Objection. Form.
15 THE WITNESS: Provides a practical
16 solution. That's what it says. I agree with
17 that.
18 BY ATTORNEY WICHMAN:
19 Q And a POSA would agree with that as well;
20 right?
21 ATTORNEY ARNOLD: Objection. Form.
22 THE WITNESS: Yes.
23 BY ATTORNEY WICHMAN:
24 Q Okay. If you can go back to your
25 declaration, reply declaration, Exhibit 1005.

1 A Yes.
2 Q Paragraph 35.
3 A Yes.
4 Q You wrote or you testified that Park,
5 Exhibit 2005, cannot constitute industry praise of
6 the '134 and '167 patents because the prior art
7 Parkin patent (Exhibit 1062) previously disclosed
8 CoFeB MgO MTJs; is that right?
9 A That's what it says.
10 Q If you could pull up Parkin now.
11 Exhibit 1062.
12 A Yes.
13 Q And if you go to Figure 3A. This is at
14 PDF page 9?
15 A PDF page 9 of Parkin. Okay. Hold on.
16 Q Exhibit 1062.
17 A Okay.
18 Q You're familiar with Figure 3A; right?
19 A Yes.
20 Q You've testified about this figure?
21 A Yes.
22 Q And you're familiar with the layers
23 called out in Figure 3A?
24 A Generally.
25 Q All right. Well, let's start with the

1 layer marked 120 prime. Do you see that?
2 A I do.
3 Q You remember that that's a magnesium
4 oxide barrier layer?
5 A Well, if you don't mind, I would like to
6 refer back to where this is described in the
7 specification, just to be certain in my answer to
8 questions about the figure.
9 Q How -- what if I -- let's do it together.
10 How about that? If you want to start with --
11 start with layer -- do you see the layer marked
12 115?
13 A Yes.
14 Q Okay. And layer 115 is shown in
15 Figure 3A as what Parkin describes as a bi-layer.
16 It comprises two layers, layers 118 and 119; is
17 that right?
18 A Right.
19 Q Okay. And if you go to column 16 -- I'm
20 sorry. If you start -- start at column 13, since
21 we're already there. At line 10. Do you see
22 that? It is at page PDF 27?
23 A 13, line 10.
24 Q Yeah.
25 A Yes.

1 Q Okay. "Layer 115 is preferably formed
2 from a bcc alloy formed from one or more of cobalt
3 and iron." Correct?
4 A Yes.
5 Q "For example, layer 118 may be formed
6 from iron or cobalt sub 84, iron sub 16. And
7 layer 119 may be formed from cobalt sub 70, iron
8 sub 30." Correct?
9 A Correct.
10 Q "And moreover, the crystallographic
11 texture of these layers can be controlled by a
12 suitable choice of the underlayers." Right?
13 A Yes.
14 Q And if you drop down to line 23, "Layer
15 115 comprised of one or more bcc cobalt iron
16 alloys is textured in the 100 orientation."
17 Right?
18 A Right.
19 Q And additionally, since we're here,
20 there's a description of substrate 111 may be
21 comprised of an amorphous material, such as a
22 silicon dioxide; correct?
23 A That's what it says, yes.
24 Q If you go back to Figure 3A, substrate
25 111 is at the bottom of this whole stack; right?

1 A Correct.
2 Q So that's an amorphous material on which
3 this layer 112 is formed; right?
4 A That's what it says. It says the
5 substrate can be comprised of an amorphous
6 material such as silicon dioxide.
7 Q All right. If you can go to -- we're at
8 Figure 3A now. We want to talk about 120 prime.
9 And you were uncertain whether that magnesium
10 oxide tunnel barrier; right?
11 A I just wanted to be absolutely certain,
12 yes.
13 Q Okay. Well, if we go to column 17, it is
14 on PDF 29.
15 A Okay.
16 Q Let me know when you're there.
17 A I'm there.
18 Q Okay. Line three, Figure 3A, the
19 direction of the magnetization of storage layer
20 175, located above the tunnel barrier 120 prime;
21 right?
22 A Right.
23 Q And then on column 18, if you drop down
24 to line 49, "Very TMR value" -- "Very high TMR
25 values are unexpectedly found for MTJs with high

1 textured 100 MgO tunnel barriers." And then if
2 you go down to line 53, it refers to MgO tunnel
3 barrier 120 prime. Right?
4 A Yes.
5 Q So 120 prime is a magnesium oxide tunnel
6 barrier with a 100 texture; correct?
7 A Correct.
8 Q And if we go back to Figure 3A, Figure 3A
9 shows that one -- the magnesium oxide tunnel
10 barrier 120 prime is formed on top of layer 119;
11 correct?
12 A Correct.
13 Q And if you go back now to column 13,
14 layer 115, comprising layers 118 and layers 119,
15 is formed from iron or cobalt iron alloys; right?
16 A Back to column 13, you say?
17 Q Yes. Describing layers 115, 118, 119.
18 A Okay. Now I'm there. Just --
19 Q All right. Line 10 again, right. We
20 just went through this.
21 A Line 10. Now, what was your question
22 about?
23 Q The layer 115 comprises layers 118 and
24 119; right?
25 A Right.

1 Q And layers 118 and 119 are formed from
2 cobalt and -- okay. Strike that.
3 Layer 115, comprising those two layers,
4 is preferably formed from a bcc alloy formed from
5 one or more of cobalt and iron; right?
6 A Right.
7 Q The example at line 12 is layer 119 is
8 formed from cobalt sub 70, iron sub 30; right?
9 A Right.
10 Q That layer has a crystallographic
11 texture?
12 A That's the start of the next sentence.
13 Q And line 24, the layer 115, which is --
14 which includes layer 119 is textured in the 100
15 orientation; right?
16 A Correct.
17 Q All right. So Figure 3A does not show
18 forming magnesium oxide on amorphous cobalt iron
19 boron, does it?
20 ATTORNEY ARNOLD: Objection. Form.
21 THE WITNESS: It doesn't show it forming
22 on top of amorphous cobalt iron boron.
23 BY ATTORNEY WICHMAN:
24 Q Okay.
25 A In Figure 3A.

1 Q That's what we're talking about right
2 now.
3 A Right.
4 Q All right. Let's talk about these layers
5 in Figure 3A with the arrows. So layer 115,
6 Parkin describes that as a reference electrode,
7 115; right?
8 A Point me to where you're referring to in
9 Parkin.
10 Q All right. If you go to PDF 28, which is
11 column 16.
12 A Okay.
13 Q Column 16, line 54, refers to a reference
14 electrode; right?
15 A Yes.
16 Q And there is -- if you drop down to 64 to
17 65, it refers to reference electrode 115; right?
18 A Yes.
19 Q Which, at line 57, is also described as
20 ferromagnetic layer 115; right?
21 A Right.
22 Q Okay. So layer 115 is reference
23 ferromagnetic layer 115; is that right?
24 A Right.
25 Q Okay. If you go to column 17, which is

1 PDF page 28, lines 1 to 2, again, layer 115 is the
2 reference electrode; right?
3 A Okay.
4 Q If you go to lines 2 to 4, there's
5 reference to storage layer 175.
6 A Yes.
7 Q And -- okay. And back at Figure 3A,
8 PDF 9, storage layer 175 has a bidirectional arrow
9 in it; right? In the figure; right?
10 A Right.
11 Q And that is directly on top of the
12 magnesium oxide barrier layer 120; right?
13 A Yes.
14 Q Let's go back to column 17, line 21 to
15 24. It refers to magnesium oxide tunnel barrier
16 120 prime. Correct?
17 A Correct.
18 Q Formed on top of the lower ferromagnetic
19 electrode 110 prime?
20 A Yes.
21 Q All right. And if you go back to
22 Figure 3A, 110 prime is -- is that whole stack at
23 the top -- is -- strike that.
24 110 prime is shown as encompassing
25 several layers, including layer 112, layer 116,

1 layer 118, and layer 119 directly below where the
2 magnesium oxide barrier layer 120 prime goes;
3 right?
4 A That's fair.
5 Q All right. So now let's go back to
6 column 17, if we can.
7 A Okay.
8 Q All right. At line 7, column 17, Parkin
9 says, "The MTJ device of Figure 3A may also be
10 inverted." Is that right?
11 A Yes.
12 Q And Parkin says that inverted means or it
13 may also be inverted such that the reference
14 ferromagnetic electrode is formed above the tunnel
15 barrier and the storage layer is formed beneath
16 the tunnel barrier; right?
17 A Right.
18 Q Okay. So Parkin is describing an
19 inverted device layers by their function; correct?
20 ATTORNEY ARNOLD: Objection. Form.
21 THE WITNESS: In that sentence, he is,
22 yes.
23 BY ATTORNEY WICHMAN:
24 Q So he refers to a reference ferromagnetic
25 electrode; right?

1 A Right.
2 Q That's the function of that electrode;
3 right?
4 A That's right.
5 Q And he refers to a storage layer; right?
6 A Right.
7 Q And that's the function of that layer;
8 right?
9 A Right.
10 Q So Parkin does not describe the layers in
11 this inverted device by their composition, does
12 he?
13 A I disagree with that.
14 Q Why do you disagree with that?
15 A That's what it does here. But you said
16 Parkin. So in order to address the question you
17 just asked, I assume when you said Parkin, you
18 mean the entirety of the Parkin disclosure. Is
19 that -- is my understanding correct?
20 Q Let's break up the question. Let's break
21 up the question. Okay. In this description, when
22 Parkin --
23 A Which description?
24 Q In Parkin, Exhibit 1062, column 17,
25 line 7 through 10, when Parkin writes, "The MTJ

1 device of Figure 3A may also be inverted such that
2 the reference ferromagnetic electrode is formed
3 above the tunnel barrier and the storage layer is
4 formed below the tunnel barrier," Parkin is not
5 describing the composition of those layers or the
6 ferromagnetic electrode or the storage layer, is
7 he?
8 ATTORNEY ARNOLD: Objection. Form.
9 THE WITNESS: In that sentence, he is not
10 describing the composition of the layers.
11 BY ATTORNEY WICHMAN:
12 Q And when Parkin describes --
13 A Not explicitly describing the composition
14 of those layers.
15 Q And when Parkin describes the inverted
16 MTJ device of -- when Parkin says that the MTJ
17 device at Figure 3A may also be inverted, Parkin
18 does not say whether other layers are needed to
19 make that inverted device, does he?
20 ATTORNEY ARNOLD: Objection. Form.
21 THE WITNESS: In this sentence, all he
22 says is the reference ferromagnetic electrode is
23 formed above the tunnel barrier and the storage
24 layer is formed beneath the tunnel barrier. If
25 you're asking me what this sentence says, it says

1 what I just read, no more, no less, explicitly in
2 this one sentence.
3 BY ATTORNEY WICHMAN:
4 Q And this sentence does not say whether
5 other layers are needed to make an inverted
6 version of the MTJ device in Figure 3A, does it?
7 A It's just one sentence. It says what it
8 says. And what it doesn't say, it doesn't say.
9 The sentence -- the add-on that you just made
10 about other layers, that language does not appear
11 in that sentence. That, I agree with.
12 Q And in this sentence, when Parkin says
13 that the MTJ device of Figure 3A may be inverted,
14 Parkin does not say what crystal structure each
15 layer in that inverted device has, does he?
16 A Once again, this sentence in the --
17 within the bounds of the words that appear in the
18 sentence, it doesn't say what you just said.
19 Those words do not appear in this sentence.
20 Q And in column 17, line 7 through 10, when
21 Parkin says that the MTJ device of Figure 3A may
22 also be inverted, Parkin does not describe how to
23 make that inverted device, does he?
24 A Not in this sentence, no.
25 Q Let's go to figure --

1 A Let me amplify on that answer just a
2 little bit because I want to -- I want to be as
3 accurate as possible. Can we just repeat that
4 question, please.
5 ATTORNEY WICHMAN: Ms. Silvas, can you
6 read the question back, please.
7 (The record was read back as
8 requested.)
9 "Q And in column 17, line 7 through 10,
10 when Parkin says that the MTJ device of Figure
11 3A may also be inverted, Parkin does not
12 describe how to make that inverted device, does
13 he?"
14 THE WITNESS: I'm going to answer no.
15 I'm going to answer that's not correct. He does.
16 BY ATTORNEY WICHMAN:
17 Q Why -- why do you say that is not
18 correct?
19 A That's the whole point of the sentence.
20 He's teaching that when the device is inverted,
21 the reference ferromagnetic electrode is formed
22 above the tunnel barrier and the storage layer is
23 formed beneath the tunnel barrier. That's a
24 description of how to make -- of how to make it.
25 Q But you just told me that he doesn't say

1 whether there are other layers in this inverted
2 device, does he?
3 A In -- okay. I'll answer that question
4 the same way. In the bounds of the words of that
5 sentence, he doesn't mention explicitly any other
6 layers. But he is giving a direction on how to --
7 how to make the inverted structure in this
8 sentence.
9 Q He doesn't say what composition materials
10 to use for the layers, does he?
11 A Not explicitly in this sentence. I think
12 there's an implication that when he says the
13 reference electrode and the storage layer, I think
14 there's an implication that he is talking about
15 the same layers that are described as -- as such
16 previously. I think it's -- I think it is a fair
17 implication of that sentence, to a person of
18 ordinary skill.
19 ATTORNEY WICHMAN: Dr. Bokor, we've been
20 going an hour. Do you feel like you need a break
21 or should we keep going?
22 THE WITNESS: A break would be great.
23 ATTORNEY WICHMAN: Why don't we take --
24 how much time do you need? Is five minutes
25 sufficient?

1 THE WITNESS: Yeah, roughly five minutes.
2 It is a little farther down the hall here to the
3 restroom. But yeah, about five minutes.
4 ATTORNEY WICHMAN: Okay. Let's do six
5 and a half minutes.
6 THE WITNESS: Thank you.
7 ATTORNEY WICHMAN: Off the record.
8 (A recess was taken.)
9 BY ATTORNEY WICHMAN:
10 Q Dr. Bokor, during the break, did you
11 speak to anybody about the subject matter of this
12 deposition?
13 A No.
14 Q Dr. Bokor, in Exhibit 1062, Parkin, can
15 you go to column 22 at PDF page 31. Let me know
16 when you're there.
17 A Column 22. Yes. I'm there.
18 Q All right. So if you go down to line 29,
19 do you see that sentence starts Figure 11?
20 A Yes.
21 Q So this sentence reads, "Figure 11 shows
22 another representative embodiment of the current
23 invention in which the structure of the device
24 shown in Figure 3A and 3B is inverted so the
25 storage layer or electrode is formed beneath the

1 tunnel barrier and the reference electrode is
2 formed above the tunnel barrier." Is that right?
3 A Yes.
4 Q If you look at Figure 11, you can pull
5 that up. That is at PDF page 17. Let me know
6 when you're there.
7 A Okay. Figure 11. I'm there.
8 Q All right. So in Figure 11, again,
9 there's this substrate 111, layer 512, and then
10 there is this set of layers 510 which comprises
11 layers 515 and 520; is that right?
12 A Correct.
13 Q And then on top of layer 510 is layer
14 540; right?
15 A Right.
16 Q And then on top of layer 540 is a set of
17 layers 560 that comprises -- immediately above
18 layer 540 is layer 555, then layer 565, and then
19 additional layers above that. Is that right?
20 A Yes.
21 Q Okay. And we will check this in a
22 second. Do you recall that in Figure 11, layers
23 510 are storage electrode 510?
24 ATTORNEY ARNOLD: Objection. Form.
25 THE WITNESS: Right.

1 BY ATTORNEY WICHMAN:
2 Q And layer 540 is the tunnel barrier. Do
3 you recall that?
4 A Yes.
5 Q And layer 560 is the reference electrode;
6 is that right?
7 A Correct.
8 Q Okay. So now if you go back to column
9 22, PDF page 32, at line 56, at the bottom, do you
10 see that paragraph refers to storage ferromagnetic
11 510; right?
12 A I see that.
13 Q And if you go to column 23, on PDF page
14 32, you will see that starting at line 14, there's
15 a sentence, "The MTJ device is completed by
16 forming reference magnetic electrode 560." Right?
17 A I see that.
18 Q And then at line 6 of column 23, there's
19 a reference to magnesium oxide tunnel barrier 540;
20 right?
21 A Right.
22 Q Okay. In Figure 11, refer back to it if
23 you need to, layer 540 is shown on top of layer
24 520; correct?
25 A That's correct.

1 Q And right here at the -- well, since
2 we're on column 23, line one says -- refers to in
3 Figure 11, a layer 520 of 15 angstroms of cobalt
4 sub 70, iron sub 30. Right?
5 A I see that.
6 Q That's what it says; right?
7 A Yes.
8 Q Okay. So layer 520 is cobalt iron. It
9 is not amorphous CoFeB. Right?
10 A As described here, yes.
11 Q Okay. And if you go back to the
12 preceding page, PDF page 31, column 22, at the
13 bottom, line 66, sentence starts, "An interface
14 layer 520 of a crystalline CoFeB alloy may be used
15 or may also be used." Right?
16 A I see that.
17 Q So layer 520 is crystalline CoFe alloy;
18 right?
19 A Layer 520 is crystalline CoFe iron.
20 Q Okay. And then Figure 11 shows forming
21 magnesium oxide tunnel barrier 540 on crystalline
22 cobalt iron layer 520; right?
23 A Well, let's be precise here. The
24 description says interface layer 520 of
25 crystalline cobalt iron alloy may also be used.

1 So 520 may -- may be used as crystalline cobalt
2 iron alloy. That may means may or may not.
3 Q Another alloy could be used for layer
4 520; right?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: Well, what it says is an
7 interface layer may also be used. Interface layer
8 520 could -- is described as crystalline cobalt
9 iron alloy. So crys- -- I suppose -- I think a
10 person of ordinary skill would understand that an
11 interface layer of crystalline cobalt iron alloy
12 or some -- an interface layer of something else
13 may also be used. But I also think a person of
14 ordinary skill reading this would understand that
15 this layer 520 might be absent. It says it may
16 also be used, which means it might -- it may also
17 not be used. So the interface layer 520 is
18 optional. And it is optionally composed of
19 crystalline cobalt iron alloy. That's the way I
20 read that sentence.
21 BY ATTORNEY WICHMAN:
22 Q Okay. Let's go back for a minute. I
23 just want to look at Figure 11. The question was
24 about Figure 11. I don't think you answered it.
25 So let's go back to Figure 11, PDF 17.

1 A Okay. Give me a moment to get back to
2 that.
3 Okay. I'm back at Figure 11.
4 Q All right. Layer 520, we just saw it, is
5 described as crystalline cobalt iron; correct?
6 A It may --
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: It may be crystalline
9 cobalt iron.
10 BY ATTORNEY WICHMAN:
11 Q Or it could be another alloy?
12 A That's the way I think a POSA would
13 understand the sentence that we're looking at in
14 the spec.
15 Q Okay. And the barrier layer -- magnesium
16 oxide barrier layer 540 in Figure 11 is formed on
17 layer 520. That was -- that's correct; right?
18 ATTORNEY ARNOLD: Objection. Form.
19 THE WITNESS: In Figure 11, yes, that's
20 correct.
21 BY ATTORNEY WICHMAN:
22 Q All right. Let's go back to column 23, I
23 believe. No. I'm sorry. 22. At the bottom, you
24 want to talk about layer 515, which is described
25 as comprising an amorphous ferromagnetic alloy.

1 And then line 62 is described 515 of CoFeB.
2 Correct?
3 A Well, I disagree with your
4 characterization that that's what I want to do.
5 That was the beginning of your sentence.
6 Q All right. Let's back up. Here in
7 column 22 --
8 A I don't have any desire to talk about
9 anything in particular here. This is your
10 deposition. If you leave it up to me, we can end
11 right now.
12 Q Column 22, PDF page 31, at line 57,
13 refers to layer 515 comprising an amorphous
14 ferromagnetic alloy; right?
15 A Correct.
16 Q Then line 62 says in Figure 11, layer 515
17 of CoFeB is deposited which is 60 angstroms thick;
18 correct?
19 A That's what it says, yes.
20 Q Okay. So it's your testimony that a POSA
21 reading this description of the inverted device in
22 Figure 11 would understand Parkin describing
23 forming magnesium tunnel barrier 540 on an
24 amorphous CoFeB layer 515? Is that your opinion?
25 A That's -- I think that's one option, yes.

1 Q Okay. And the magnesium oxide tunnel
2 barrier 540 is described starting at column 23,
3 line 6; right?
4 A I see that.
5 Q A magnesium oxide tunnel barrier 540 is
6 then formed according to the methods described in
7 U.S. patent application serial number 10/824,835
8 to Parkin and serial number 10/646,246 to Parkin.
9 Correct?
10 A That's what it says, yes.
11 Q And you reviewed those applications;
12 right?
13 A Once upon a time. I have reviewed those
14 applications actually. But I don't have them
15 memorized. I can't answer questions about them
16 off the top of my head, if that's where we're
17 going to go.
18 ATTORNEY WICHMAN: So I'm going to --
19 there's a document marked Exhibit 2079 in the
20 chat. I would like you to open that up.
21 THE WITNESS: In the chat.
22 (Bokor Exhibit 2079 was marked for
23 identification by the court reporter.)
24 BY ATTORNEY WICHMAN:
25 Q Do you have that document open?

1 A I just opened it. 2079. Yes, I have it.
2 A hundred pages.
3 Q So I would like you to go to PDF 7,
4 page 7.
5 A Page 7. Okay. I'm there.
6 Q All right. Do you see on the top right,
7 next to that bar code, in vertical font, there's a
8 number 10/824,835?
9 A I see that.
10 Q Okay. And that's the same number as this
11 patent application serial number 10/824,835 that's
12 identified in Parkin, column 23, at line 8;
13 correct?
14 A Okay. Give me a moment to go back to
15 Parkin. 824,835. 824,835. Yeah. Those match.
16 Q Okay. And if you go back now to
17 Exhibit 2079, page 7, PDF 7, do you see this block
18 18?
19 A 18.
20 Q Yeah. So it is a block that says "If a
21 continuing application."
22 A I see that.
23 Q Do you see there's a checkmark in a box
24 next to continuation-in-part, parenthesis, CIP?
25 A I see that.

1 Q And then to the right of that, it says
2 prior application 10/646,246; right?
3 A Yes, I see that.
4 Q Now, if you go back to Exhibit 1062,
5 column 23, at line 10, the second patent
6 application that is referenced here for the
7 methods used to form MgO barrier 540 is
8 application number 10/646,246; right?
9 A I see that.
10 Q It is the same application number; right?
11 A I see that, yes.
12 Q Okay. Now let's -- I want to -- let's
13 stay with Exhibit 2079 here.
14 A 207- -- okay.
15 Q All right. If you go to PDF page 58.
16 Just let me know when you're there.
17 A Okay.
18 Q All right. Starting at line 1, first
19 paragraph, it says, "While the method of forming
20 an improved MgO tunnel barrier has been described
21 with respect to the formation of magnesium oxide
22 barriers on polycrystalline underlayers, the
23 method can also be used for the formation of
24 improved magnesium oxide tunnel barriers on
25 crystalline underlayers prepared on crystalline

1 substrates." Correct?
2 A That's what it says here.
3 Q And when it refers to an underlayer here,
4 you understand that that refers to the
5 ferromagnetic layer on which the magnesium oxide
6 tunnel barrier is formed; right?
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: Well, are you asking me
9 that question about Exhibit 2079?
10 BY ATTORNEY WICHMAN:
11 Q Okay. With reference -- with respect to
12 Parkin, Exhibit 11 -- Exhibit 1062, Figure 11.
13 A 1062, Figure 11. Okay. I'm back there.
14 Q All right. You would agree that layer
15 storage electrode 510, the top of storage layer
16 electrode 510 is -- is a ferromagnetic underlayer;
17 correct?
18 A Okay.
19 Q All right. So let's go back to
20 Exhibit 2079.
21 A 2079. Okay.
22 Q Page 58, PDF page 58.
23 A Right.
24 Q Line 1, it is saying that a -- a method
25 of forming an improved magnesium oxide tunnel

1 barrier has been described with respect to the
2 formation of the magnesium oxide barriers on
3 polycrystalline underlayers; right?
4 A Right.
5 Q That means the layer that the magnesium
6 oxide tunnel barrier is formed on top of; right?
7 A That's what this sentence means.
8 Q Okay. And then that sentence continues
9 that this method can also be used formation of
10 improved magnesium tunnel -- magnesium oxide
11 tunnel barriers on crystalline underlayers; right?
12 A That's what it says.
13 Q So this passage here is not describing
14 forming magnesium oxide tunnel barriers on any
15 amorphous underlayer, is it?
16 ATTORNEY ARNOLD: Objection. Form.
17 THE WITNESS: You're talking about the
18 sentence in Exhibit 2079?
19 BY ATTORNEY WICHMAN:
20 Q What we just read, yeah.
21 A No. It doesn't -- I agree, that sentence
22 does not mention amorphous underlayer.
23 Q Okay. Can you turn to page 24.
24 A Which document?
25 Q We're going to stay with Exhibit 2079.

1 A Page 24? Is that PDF page 24?
2 Q Yeah. When I give you the page numbers
3 in this document, they're going to line up with
4 the page numbers stamped on the bottom.
5 A Good enough.
6 Q Okay. Just let me know when you're
7 there.
8 A Page 24, I'm there.
9 Q All right. Do you see line 21?
10 A I see that.
11 Q All right. Do you see the sentence
12 reads, "Oxygen and additional magnesium are then
13 directed onto the metal layer to form a magnesium
14 oxide tunnel barrier that is in contact with the
15 underlayer in which the ferromagnetic underlayer
16 is selected to be bcc and at least partially 100
17 oriented to improve the performance of the tunnel
18 barrier." Correct?
19 A Okay. Yes. I see that.
20 Q So that sentence does not describe using
21 an amorphous CoFeB underlayer, does it?
22 ATTORNEY ARNOLD: Objection. Form.
23 THE WITNESS: Not in this sentence. I
24 agree.
25

1 BY ATTORNEY WICHMAN:
2 Q Okay. And did you consider this sentence
3 when forming your opinion that Parkin described
4 forming 100 magnesium oxide on an amorphous CoFeB
5 ferromagnetic layer?
6 A I --
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: I believe I was aware of
9 this particular document when I formed that
10 opinion.
11 BY ATTORNEY WICHMAN:
12 Q Did you consider this description that we
13 just read of forming a magnesium oxide on a
14 ferromagnetic underlayer selected to be bcc and at
15 least partially 100 oriented to improve the
16 performance of the tunnel barrier when you formed
17 the opinion that Parkin describes forming
18 magnesium oxide on amorphous CoFeB?
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: I -- I guess I would have
21 to say I considered it. I certainly was aware of
22 it when I formed my opinion.
23 BY ATTORNEY WICHMAN:
24 Q Okay. If you can go to page 25, line 8.
25 Just let me know when you're there.

1 A Page 25, line 8. I'm there.
2 Q Okay. It's at the end of line 8, the
3 sentence starts, "Preferably, the ferromagnetic
4 material of the overlayer and the ferromagnetic
5 material of the underlayer, as well as the MgO
6 tunnel barrier, are substantially 100 oriented."
7 Did I read that correctly?
8 A You did.
9 Q All right. The ferromagnetic -- the
10 ferromagnetic material overlayer is the layer
11 above the MgO tunnel barrier; right?
12 ATTORNEY ARNOLD: Objection. Form.
13 THE WITNESS: That's right.
14 BY ATTORNEY WICHMAN:
15 Q And the ferromagnetic material underlayer
16 is the layer on which the magnesium oxide tunnel
17 barrier is formed; correct?
18 A Correct.
19 ATTORNEY ARNOLD: Objection. Form.
20 BY ATTORNEY WICHMAN:
21 Q Did you -- so this sentence here at
22 Exhibit 2079, page 25, lines 8 through 10, doesn't
23 describe forming magnesium oxide tunnel barrier on
24 an amorphous underlayer CoFeB, does it?
25 ATTORNEY ARNOLD: Objection. Form.

1 THE WITNESS: Okay. Well, as I said, I
2 have reviewed this. It's been a while since I
3 reviewed it. I would need a little time to review
4 the document further to answer your question.
5 Only because in this sentence, it doesn't say
6 anything about the details of how the -- give me a
7 moment.
8 Yeah. I would need to read this a little
9 more carefully. I would note that the -- just
10 prior to the sentence that you're referring to, it
11 says -- it describes annealing. And then after
12 the anneal is a sentence, "Preferably, the
13 ferromagnetic material of the overlayer and the
14 underlayer are substantially 100 oriented." So
15 this sentence is not -- I don't think this
16 sentence tells me anything about what the -- what
17 the crystal structure of the underlayer was when
18 the MgO was first deposited.
19 BY ATTORNEY WICHMAN:
20 Q Okay. If you could look at page 26,
21 line 5. Just let me know when you're there.
22 A I'm there.
23 Q So this sentence reads, "The preferred
24 embodiments and the implementations herein are
25 directed to structures in which the magnetic

1 material has a body-centered cubic (bcc) lattice,
2 since this lattice type leads to the best
3 performance of the magnesium oxide tunnel barrier
4 (e.g., the highest TMR for magnesium oxide tunnel
5 junction)." Right?
6 A You read it correctly.
7 Q And a bcc magnetic material is not
8 amorphous, is it?
9 ATTORNEY ARNOLD: Objection. Form.
10 And this exhibit is not in the IPR
11 record, so I don't even know why we're talking
12 about it right now.
13 BY ATTORNEY WICHMAN:
14 Q Did you hear my question?
15 A I heard your question.
16 Ms. Arnold, are you trying to give me any
17 instruction here or are you just making a
18 statement for the record?
19 ATTORNEY ARNOLD: I'm objecting for the
20 record that this exhibit is not in the IPR record
21 for either IPRs, 14- -- geez. Now I don't
22 remember the numbers. The IPR for the '134 patent
23 and the IPR for the '167 patent. So I don't know
24 why we're talking about it right now.
25 ATTORNEY WICHMAN: Counsel, your -- your

1 speaking objections are improper. The Trial
2 Practice Guide requires you to limit your
3 objections to a single statement. And it is very
4 evident that your witness is asking you to coach
5 him. So I'm going to ask you now -- and I'm going
6 to keep track of how often I need to ask you -- to
7 limit your objections to objections that are
8 proper and consistent with the guidance in the
9 consolidated Trial Practice Guide.
10 ATTORNEY ARNOLD: I'm aware of the
11 guidance. And the guidance also says no new
12 exhibits should append a surreply. So we're both
13 familiar with the Practice Guide.
14 ATTORNEY WICHMAN: Do you intend to
15 continue speaking objections in this deposition,
16 Ms. Arnold?
17 ATTORNEY ARNOLD: If you continue to
18 bring up things that are not in the scope of his
19 second declaration, Exhibit 1105, yes.
20 BY ATTORNEY WICHMAN:
21 Q Dr. Bokor, the question was, a bcc
22 magnetic material is not amorphous, is it?
23 ATTORNEY ARNOLD: Objection. Form.
24 THE WITNESS: Generally, no. Presumably,
25 no.

1 BY ATTORNEY WICHMAN:
2 Q Okay. And at page 26, lines 5 through 8,
3 Parkin says that "the magnetic material with a
4 body center cubic (bcc) lattice, this lattice type
5 leads to the best performance of the magnesium
6 oxide tunnel barrier (e.g. the highest TMR for a
7 magnesium oxide tunnel junction)." Right?
8 A That's what it says.
9 Q And it's your testimony that a person of
10 ordinary skill in the art would have formed or
11 been motivated to combine Bowen with Sunai or
12 Parkin to improve TMR; right?
13 ATTORNEY ARNOLD: Objection. Form.
14 THE WITNESS: Yes.
15 BY ATTORNEY WICHMAN:
16 Q And it's your testimony that a POSA would
17 have been motivated to combine Nagahama with Sunai
18 or Parkin to improve TMR?
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: Yes. That's -- that's the
21 opinion that I've given in my declaration, yes.
22 BY ATTORNEY WICHMAN:
23 Q So a POSA reading Parkin would have
24 understood that Parkin says the highest TMR is
25 achieved when the magnetic material has a

1 body-centered bcc -- a body-centered cubic (bcc)
2 lattice; right?
3 ATTORNEY ARNOLD: Objection. Form.
4 THE WITNESS: That's what it says here,
5 yes.
6 BY ATTORNEY WICHMAN:
7 Q So Parkin is saying a POSA that is
8 seeking to maximize TMR would use a bcc magnetic
9 material for a ferromagnetic underlayer; right?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: Yeah. That's what it is
12 saying here, yeah.
13 BY ATTORNEY WICHMAN:
14 Q All right. If you drop down to line 14.
15 A 14 in the same page?
16 Q Yeah. Page 26.
17 A Page 26.
18 Q It is the next paragraph.
19 A Line 14. Okay. I'm with you.
20 Q Okay. "The preferred embodiments and
21 implementations of the invention are directed to
22 magnetic layers and MgO tunnel barrier layers
23 which are substantially 100 oriented or textured."
24 Right?
25 A Yes.

1 Q All right. A magnetic layer that is
2 substantially 100 oriented or textured is not
3 amorphous, is it?
4 ATTORNEY ARNOLD: Objection. Form.
5 THE WITNESS: Not -- no. If it's -- once
6 it is substantially 100 oriented and textured, it
7 is not amorphous.
8 BY ATTORNEY WICHMAN:
9 Q And the next sentence starts with the
10 magnetic barrier tunnel layers are
11 polycrystalline?
12 A Right.
13 Q Well, a polycrystalline magnetic layer is
14 not amorphous, is it?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: No.
17 BY ATTORNEY WICHMAN:
18 Q All right. If we go to page 27, if you
19 drop down to line 10 -- just let me know when
20 you're there.
21 A I'm there.
22 Q All right. The sentence reads, "It is
23 the orientation or texturing of the film which is
24 important with regard to the preferred embodiments
25 herein. Whereas the maximum TMR is obtained for

1 film structures which are highly textured, the TMR
2 will be increased to the extent that the film
3 structure is textured." Right?
4 A I -- you read it correctly.
5 Q Okay. And if we go back to the previous
6 page 26 at lines 14, the antecedent for film
7 structures is the group of ferromagnetic
8 underlayer, the barrier, and the ferromagnetic
9 overlayer; right?
10 ATTORNEY ARNOLD: Objection. Form.
11 BY ATTORNEY WICHMAN:
12 Q Let's do it like this, Dr. Bokor. At
13 line 14, it says that the preferred embodiments
14 and implementations of the invention are directed
15 to magnetic layers and magnesium oxide tunnel
16 barrier layers; right?
17 A Yep.
18 Q Then if you drop down one, two sentences,
19 it says -- at line 18, it says, "These layers and
20 the overall film structure are what are commonly
21 referred to as textured." Right?
22 A That's what it says.
23 Q And then if you go now to page 27, at
24 line 12, it refers to maximum TMR is obtained for
25 film structures which are highly textured; right?

1 A Right.
2 Q So in that sentence film structures
3 refers to the ferromagnetic, the barrier layer,
4 and the ferromagnetic overlayer; right?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: That's fair.
7 BY ATTORNEY WICHMAN:
8 Q And so Parkin is saying that you get the
9 maximum TMR for highly textured film structures;
10 right?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: That's fair.
13 BY ATTORNEY WICHMAN:
14 Q So highly textured film structures -- an
15 amorphous underlayer is not a textured film
16 structure, is it?
17 ATTORNEY ARNOLD: Objection. Form.
18 THE WITNESS: That's -- as stated
19 narrowly, yes, I agree.
20 BY ATTORNEY WICHMAN:
21 Q Okay. Drop down to the bottom paragraph,
22 starting at line 19.
23 A Okay.
24 Q All right. "Notwithstanding the
25 polycrystalline nature of the film structures

1 described herein, which are in any case preferable
2 for ease of manufacturing, the method of forming
3 the magnesium oxide tunnel barrier described
4 herein can also be applied to the growth of
5 epitaxial single crystalline film structures
6 wherein the structures are prepared on the face of
7 a single crystalline substrate chosen so the
8 crystalline spacing and crystalline cell is
9 compatible with the growth of a bcc ferromagnetic
10 metal layer oriented in the 100 growth direction
11 and the subsequent growth of a magnesium oxide
12 tunnel barrier according to one of the preferred
13 embodiments described herein." Right?
14 A You read it correctly.
15 Q So a polycrystalline film is preferable
16 for manufacturing, for ease of manufacturing;
17 right?
18 ATTORNEY ARNOLD: Objection. Form.
19 THE WITNESS: That's what it says.
20 BY ATTORNEY WICHMAN:
21 Q Okay. He doesn't say an amorphous film
22 is preferable for ease of manufacturing, does he?
23 ATTORNEY ARNOLD: Objection. Form.
24 THE WITNESS: He doesn't say that
25 explicitly here. But a person of ordinary skill

1 in the art would know that.
2 BY ATTORNEY WICHMAN:
3 Q Okay. And so where this continues over
4 on page 28, line 1 -- well, I'm sorry. This whole
5 passage I read continued over to 28 line 3; right?
6 So the last part of this, Parkin is describing the
7 growth of the bcc ferromagnetic layer oriented in
8 the 100 direction because that provides a template
9 for subsequent growth of magnesium oxide tunnel
10 barrier; right?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: Well -- so in this
13 paragraph, he starts out saying that
14 "Notwithstanding the polycrystalline nature of the
15 film structures described herein," which are
16 preferable for ease in manufacturing. He then
17 goes on to describe a method that can be applied
18 to the growth of epitaxial structures. And in
19 that context, the subsequent growth of the MgO
20 tunnel barrier is described. I don't see anything
21 about the word templating. But the context is in
22 the context of epitaxial single crystal --
23 crystalline film structures. I don't know if I am
24 agreeing or disagreeing with your statement. I
25 read it differently than the way -- the words that

1 you used. So I'm just telling you what I
2 understand this paragraph to be describing.
3 BY ATTORNEY WICHMAN:
4 Q Okay. Can you go to page 32.
5 A 32.
6 Q Line 13.
7 A 32, line 13. I'm there.
8 Q Okay. Do you see the sentence, at the
9 end of line 13, it reads, "As shown in Figures 2A
10 and 2B, the fixed ferromagnetic layer may actually
11 be a bilayer 115 of two different ferromagnetic
12 layers 118 and 119." Right?
13 A That's what it says.
14 Q And the next sentence says, "The bilayer
15 115, the antiferromagnetic layer 116, and then the
16 bottom lead 112 of Figures 2A and 2B constitute a
17 lower electrode 110." Right?
18 A Yes.
19 Q And then if you want to see these for
20 yourself, Figure 2A is at page 65. If you want to
21 look at that stack briefly.
22 A Lower electrode 110. What did you say
23 page -- page.
24 Q Page 65 is Figure 2A and page 66 is
25 Figure 2B.

1 A Okay. I see those figures.
2 Q All right. So, for example, on page 66
3 Figure 2B, there's a layer 120 prime on top of
4 layer 119; right?
5 A Right.
6 Q Okay. So now if you can go to page 35,
7 at line 10.
8 A Okay.
9 Q It says that the lower ferromagnetic
10 electrode may be formed from a bilayer 115 of
11 cobalt sub 84, iron sub 16, parenthesis, layer
12 118, and iron, parenthesis, layer 119; right?
13 A That's what it says.
14 Q Okay. So iron is not amorphous CoFeB, is
15 it?
16 ATTORNEY ARNOLD: Objection. Form.
17 THE WITNESS: I'll agree with that.
18 BY ATTORNEY WICHMAN:
19 Q Good. Now we're cooking with gas. The
20 next --
21 A What kind of gas is that?
22 Q Next question. Next sentence. "The
23 cobalt sub 84, iron sub 16, layer 118 grows 100
24 oriented on top of the 100 textured
25 iridium-manganese layer 116." Right?

1 A Right.
2 Q "Then the iron layer 119, which is grown
3 on top of the 100 oriented cobalt sub 84, iron sub
4 16, layer 119, is bcc and also grows 100
5 oriented." Right?
6 A You read it correctly.
7 Q All right. So bcc 100 iron is not
8 amorphous CoFeB, is it?
9 ATTORNEY ARNOLD: Objection. Form.
10 THE WITNESS: That's true.
11 BY ATTORNEY WICHMAN:
12 Q Okay. And then the next sentence, "By
13 preparing a 100 oriented bcc template layer of
14 iron, the magnesium oxide deposited on top of this
15 layer also grows 100 oriented." Right?
16 A That's what it says.
17 Q "Thus, for this combination of layers,
18 the magnesium oxide barrier 120 prime that is
19 formed also grows texture in the 100 direction,
20 thereby leading to high TMR." Right?
21 A You read it correctly.
22 Q "Then by changing the layer 112 or by
23 changing the antiferromagnetic layer 116, the
24 texture of the lower ferromagnetic electrode can
25 be varied." Right?

1 A You read it correctly.
2 Q All right. So this is describing
3 fabricating a device in which the texture for each
4 layer of the stack influences the texture of the
5 layer on top of it; right?
6 ATTORNEY ARNOLD: Objection. Form.
7 THE WITNESS: Okay. Here's what I want
8 to say. I have in the past reviewed this
9 document. But I have not reviewed it any time in
10 the recent past. It was quite a while ago. I did
11 look -- I did look at it. And I'm willing to
12 answer questions where you ask -- you read the
13 sentence to me and say, is that what it says, then
14 I confirm, yes, it said that. Now, as soon as you
15 start asking me to answer questions about
16 interpreting any of the statements in here, I'm
17 going to have to demur and say in order for me to
18 provide any answers where you ask me questions to
19 interpret anything that is written in this
20 document, I'm going to say I'm not prepared to
21 answer such questions now and I would need time,
22 separate time, to be able to review the document
23 and consider it carefully before I answer a
24 question about -- you know, that is an
25 interpretation of what it means. I can agree that

1 a bcc crystalline iron is not amorphous.
2 That's -- that's something that I can answer
3 without reviewing the document and without
4 requiring a full review to give an interpretation.
5 Simple questions like that, I'm comfortable with.
6 But now you're starting to get into having me
7 interpret meaning of some of the descriptions in
8 this document, which I'm not comfortable to do
9 without having an opportunity to make a careful
10 study of the whole document.
11 BY ATTORNEY WICHMAN:
12 Q Dr. Bokor, in Parkin, Exhibit 1062, can
13 you go to column 3 at PDF page 22.
14 A Column 3 in Parkin. I'm there.
15 Q Can you go down to line 24.
16 A Yes.
17 Q Do you see where it says, "U.S. patent
18 application serial number 10/824,835 to Parkin
19 entitled Magnesium Oxide Tunnel Barriers and
20 Method of Formation, parenthesis, filed
21 April 14th, 2004, close parenthesis, which is
22 hereby incorporated by reference"? Do you see
23 that?
24 A I see that.
25 Q Do you understand what it means for a

1 document to be incorporated by reference?
2 A Generally.
3 Q What's your understanding of that?
4 A It means that the document is to be
5 considered part of the disclosure.
6 Q Is --
7 A The document that is being incorporated
8 by reference is now to be considered as part of
9 the disclosure.
10 Q And what we have been discussing as
11 Exhibit 2079 is U.S. patent application serial
12 number 10/824,835; right?
13 A That's right.
14 Q This disclosure in Exhibit 2079 is part
15 of the disclosure in Exhibit 1062. Do you
16 understand that?
17 A I do.
18 Q And you told me that you reviewed this
19 patent application; correct?
20 A I did.
21 Q So when you formed your opinions about
22 Parkin's disclosure, you took into account
23 everything that is taught in this patent
24 application; right?
25 A Right.

1 Q Okay. So why aren't you prepared to
2 testify about it today?
3 A I'm not prepared to testify about a
4 detailed analysis of that part of the application
5 because today I'm here to testify about my reply
6 declaration. My second declaration. And to the
7 extent that my second declaration and my responses
8 to Dr. Ross refer to Parkin, I've gone back and
9 referred to -- read the relevant parts of Parkin.
10 This application that you're talking about, while
11 of interest and part of Parkin, Parkin has got a
12 lot of things disclosed in this -- in this patent
13 application and in this serial patent -- patent
14 application that you're mentioning, as well as the
15 disclosure in the patent itself. There's a lot of
16 stuff in here. I didn't -- I looked -- to prepare
17 my opinions for my second declaration, I focused
18 on certain aspects that informed my opinion. What
19 I'm telling you right now is these details that
20 you're going into about this patent application, I
21 didn't consider as depositive towards my opinions
22 given in my second declaration.
23 Q In your -- do you have that declaration
24 Exhibit 105 from -- on the '167 patent open?
25 A I do.

1 Q Okay. All right. Can you go to
2 paragraph 35, on page 31.
3 A Yes.
4 Q It should be your PDF page 34.
5 A Right.
6 Q Okay. You expressed the opinion that
7 Parkin previously disclosed CoFeB MgO MTJs.
8 A Correct.
9 Q So it is your testimony that Parkin
10 described forming 100 textured magnesium oxide
11 barrier layers on amorphous CoFeB ferromagnetic
12 underlayer; is that right?
13 A Yes. And let me explain what I mean by
14 that. It was well known in the art that MgO
15 textured 100 layers could be deposited and formed
16 on amorphous CoFeB. Parkin does not explicitly
17 discuss that in the sections that we've been
18 discussing. But it was well known in the art. So
19 when I say the prior art patent previously
20 disclosed CoFeB MgO MTJs, that's within the
21 context of a person of ordinary skill in the art.
22 So a person of ordinary skill in the art reading
23 Parkin would know that bcc MgO texture
24 deposited -- could be deposited and formed on
25 amorphous CoFeB. Further, Parkin teaches after

1 anneal, the CoFeB gets crystallized. So in my
2 opinion, a person of ordinary skill in the art
3 would understand Parkin to disclose CoFeB MgO MTJs
4 with high TMR coming from 100 textured
5 ferromagnetic layers on both sides of the MgO.
6 Q Dr. Bokor, you just testified that it was
7 well known in the art that magnesium oxide
8 textured 100 layers could be deposited and formed
9 on amorphous CoFeB; right?
10 A Yes.
11 Q Where in your declaration do you cite a
12 single example of a -- of forming 100 magnesium
13 oxide barrier layers on amorphous CoFeB
14 ferromagnetic underlayers?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: In my declaration, I cite
17 numerous examples in the literature that teach
18 that MgO 100 textured can be deposited on any
19 amorphous layer. Glass, silicon nitride. And
20 some of those references use very broad
21 terminology that say any underlayer.
22 BY ATTORNEY WICHMAN:
23 Q Dr. Bokor, where in your declaration do
24 you cite a single example of forming a magnesium
25 oxide barrier layer with a 001 crystal plane that

1 is preferentially oriented on amorphous CoFeB
2 ferromagnetic underlayer?
3 ATTORNEY ARNOLD: Objection. Form.
4 BY ATTORNEY WICHMAN:
5 Q Dr. Bokor, I'm going to strike that
6 question and ask it again because I think there
7 were some numbers transposed in the transcription.
8 So let me try this again.
9 So, Dr. Bokor, where in your declaration
10 do you cite a single example of forming a
11 magnesium oxide layer that is polycrystalline in
12 which a 001 crystal plane is preferentially
13 oriented on top of an amorphous CoFeB
14 ferromagnetic underlayer?
15 ATTORNEY ARNOLD: Objection to form.
16 THE WITNESS: I understand the question.
17 It will take me a moment.
18 Let's start with page -- number page 11,
19 PDF page 14 of my -- of Exhibit 1105. Can you
20 give me a --
21 BY ATTORNEY WICHMAN:
22 Q Paragraph 13.
23 A 13.
24 Q Paragraph 13.
25 A Starting at the beginning of paragraph

1 13. "Dr. Yuasa's 2004 Nature Materials article
2 also stated that," quote, "even textured
3 iron/MgO/iron MTJs with 001 orientation," dot,
4 dot, dot, "can be prepared on any kinds of
5 substrates using a highly oriented MgO 001 seed
6 layer." In support -- of Exhibit 2008. It goes
7 on, "In support of that statement, he cited to a
8 2000 Inaba publication, page 871, reference 21,
9 which I will discuss in the following paragraphs."
10 I state here, in this -- I go on to state in this
11 paragraph, "The import of Dr. Yuasa's statement to
12 one of skill in the art is MgO 001 can be formed
13 on any substrate and used as a model to form
14 crystalline layers in the 001 orientation about
15 the MgO 001 seed layer. In other words, one of
16 skill understood that MgO is so flexible in
17 forming crystalline structure that it can be used
18 to create 001 orientation on any substrate to act
19 as a pattern for that structure for the rest of
20 the MTJ."
21 Now I then go on -- well, let's just stop
22 right there. I think that's -- that already is
23 responsive to your question. In my declaration
24 right here, I'm saying that MgO 001, which to one
25 of ordinary skill in the art means oriented

1 polycrystalline textured 001 MgO, can be grown on
2 any substrate. That's even according to
3 Dr. Yuasa. But that Yuasa 2004 paper is citing a
4 prior art paper Inaba for the conclusion that
5 textured iron/MgO/iron MTJs with 001 orientation
6 can be prepared on any kinds of substrates,
7 including amorphous substrates like glass.
8 Q Dr. Bokor in paragraph 13 of your reply
9 declaration, number 1105, you are quoting
10 Dr. Yuasa's 2004 Nature Materials paper as
11 describing the iron/magnesium oxide/iron MTJ being
12 prepared on the substrate, not magnesium oxide
13 barrier layer being prepared on amorphous CoFeB
14 ferromagnetic underlayer; isn't that right?
15 A What I -- what I'm saying here in my
16 declaration is that MgO 001 can be formed on any
17 substrate, include -- and that to one of ordinary
18 skill in the art would include amorphous CoFeB.
19 And that MgO could also be used as a barrier layer
20 because it's not limited in thickness. If you go
21 and you look in detail at the Inaba reference,
22 which I go into some detail in my declaration,
23 discloses that the MgO forms in the 001 structure
24 right at the inception. So even though this
25 particular discussion here is describing a seed

1 layer, a person of ordinary skill would understand
2 that you can grow MgO highly oriented on amorphous
3 CoFeB.
4 Q Dr. Bokor, Inaba --
5 A That's what Dr. Yuasa even is agreeing --
6 that's what Dr. Yuasa said.
7 Q Dr. Bokor, Inaba is Exhibit 1098; is that
8 right?
9 A Inaba is Exhibit 1098, yes.
10 Q And Inaba describes forming magnesium
11 oxide on a glass substrate; is that right?
12 A Yes.
13 Q Is a glass substrate amorphous CoFeB?
14 A A glass substrate is amorphous.
15 Q Is a glass substrate amorphous cobalt
16 iron boron?
17 A No. It is not --
18 Q Would a POSA regard --
19 A Hold on. Hold on.
20 Q Would a POSA regard amorphous cobalt iron
21 boron as a glass substrate?
22 A Let's -- let's back up. You asked is
23 amorphous CoFeB a glass substrate. Let me answer
24 that question because I don't think I got a chance
25 to answer that question. Or if I did, I misspoke.

1 Let me answer that question. Inaba is referring
2 to soda lime glass substrates. That's not
3 amorphous CoFeB. I agree with that. However, in
4 the art, the word glass is rather broad. The art
5 is full of references to glassy substrates.
6 Glassy substrates in the art refer to amorphous
7 materials. In the common parlance, glass is like
8 what we make our windows out of. And soda lime
9 glass is an example of material that is used, for
10 example, in windows. But in the art, glass has a
11 more technical meaning. And I would argue
12 although I -- since you asked, I did not -- I
13 don't right now have a reference that I can put in
14 front -- in front of you to support my opinion.
15 But I know a person of ordinary skill in the art
16 looking at an amorphous CoFeB substrate could well
17 describe that as a glass substrate.
18 Q Dr. Bokor, Inaba Exhibit 1098 did not
19 form magnesium oxide on amorphous cobalt iron
20 boron, did he?
21 A That's -- I agree with that.
22 Q And in Yuasa's 2004 Nature Materials
23 paper, that does not describe forming magnesium
24 oxide on amorphous cobalt iron boron, does it?
25 A I -- I have to disagree with that

1 statement.
2 Q Dr. Bokor, what is a seed layer?
3 A Well, let's not get into the broadest
4 general definition of a seed layer. I suspect you
5 want to know what they mean by seed layer in the
6 references that we're discussing in the context of
7 this case. Is that correct?
8 Q You quote in paragraph 13 of your
9 declaration, Exhibit 1105, in the first sentence,
10 you quote Dr. Yuasa from 2004 Nature Materials
11 describing preparing an iron/magnesium oxide/iron
12 MTJ on a seed layer. And I want to know what a
13 seed layer is in that sentence.
14 A In that sentence. Thank you for that
15 clarification. Yes. So in this -- in this
16 context, MgO is grown on an amorphous substrate,
17 glass. And the MgO, when it grows on the
18 amorphous substrate forms a highly oriented
19 MgO 001 layer. That is described in this -- in
20 this paper -- in this excerpt as a seed layer
21 because then it goes on to grow textured iron,
22 MgO iron, on top of that seed layer. And in this
23 context, he's -- he's teaching the formation of
24 crystalized iron/MgO/iron stack. Somewhat similar
25 to what we were talking about earlier. So the

1 seed layer -- the MgO seed layer is used to create
2 a crystalline template for the growth of the iron,
3 ferromagnetic underlayer of the MTJ, on a
4 crystalline 001 MgO layer, which then provides the
5 seed for the formation of crystalline iron on top
6 of it. That's what it means by a seed layer.
7 Q So the important characteristic of a seed
8 layer is the texture of the surface on top that
9 provides a template for subsequent layers; is that
10 right?
11 A I would disagree.
12 Q Why do you disagree with that?
13 A The whole -- the importance is the entire
14 layer is crystallized.
15 Q Why is that?
16 A Because it is forming a seed layer. You
17 have a fully crystallized layer. If you had -- if
18 you had an amorphous layer with, you know, a
19 monolayer of crystalline structure on top, it is
20 not at all clear that would perform the function
21 of the seed layer that is needed here. So the
22 structure of the entire layer I think is relevant
23 to its function as a seed layer.
24 Q Does Nagahama-- Nagahama's double
25 magnesium oxide underlayer have an entire -- is

1 that -- let me strike that.
2 You testified -- you had testimony about
3 Nagahama's double underlayer; correct?
4 A Correct.
5 Q And Nagahama's double underlayer there is
6 amorphous magnesium oxide followed by 001 textured
7 magnesium oxide; right?
8 A Let's just go to Nagahama. Let me just
9 go to the section in my -- let's just start with
10 my declaration. Okay. So I'm -- in my
11 declaration on -- what's your preference for page
12 numbers in the declaration?
13 Q Let's go by paragraphs.
14 A Paragraphs. Fine. Paragraph starts --
15 paragraph 20 is where I discuss Nagahama. And
16 as -- as you were just characterizing -- I'll just
17 quote from the declaration. "Nagahama explains
18 that," quote, "MgO grows amorphous to be the
19 amorphous MgO layer in the early stage and then,
20 to be the MgO 001 oriented highly oriented crystal
21 layer 203." That's -- that's a quote from
22 Nagahama.
23 Q The fact that the bottom part of that
24 double underlayer is amorphous is what allows that
25 double underlayer to be formed on any substrate;

1 correct?
2 A I disagree.
3 Q You testified right here that the
4 magnesium oxide double underlayer can be provided
5 on amorphous substrate such as that of silicon
6 dioxide. Right?
7 A That's -- that's one example, yes.
8 That's true. But it is not required. I cite --
9 you know, we can go through it. I cite to other
10 references in this declaration that show the
11 formation of 001 oriented MgO at the inception of
12 the growth.
13 Q So Dr. Bokor --
14 A More than one -- there's more than one
15 reference that teach that on an amorphous
16 substrate. Nagahama, he reports having an
17 amorphous underlayer in the MgO. That is one --
18 you know, that's what he got in his deposition
19 conditions. Other researchers have found the
20 formation of MgO highly oriented crystal on
21 amorphous substrates right within the first couple
22 of -- let's say at least within the first
23 nanometer, that's the best that they could measure
24 was crystallized.
25 Q Dr. Bokor, you recall we discussed

1 Exhibit 2005? That was the paper by Chando Park.
2 A Park. Let's go all the way back to that
3 one. 2005.
4 Q Do you recall that?
5 A I do.
6 Q Do you recall Figure 9 on page 40?
7 A Figure 9. I do.
8 Q Okay. And you see Figure 9 is a TEM
9 image that shows magnesium oxide sandwiched
10 between two cobalt iron boron layers; right?
11 A Right.
12 Q And when those cobalt iron boron layers
13 were deposited, Park describes them as being
14 amorphous; right?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: Yes.
17 BY ATTORNEY WICHMAN:
18 Q He does. The cobalt iron boron is
19 amorphous when it is deposited in the MTJ that
20 Park is describing; right?
21 ATTORNEY ARNOLD: Objection. Form.
22 THE WITNESS: Right. I'm going to read
23 from the caption of Figure 9. "The as deposited
24 CoFeB is purely amorphous while the directly
25 deposited MgO layer clearly shows a well-oriented

1 001 texture."
2 BY ATTORNEY WICHMAN:
3 Q All right. So, Dr. Bokor, I want you to
4 tell me of an example that you cite in the prior
5 art that shows this very specific relationship of
6 forming 001 magnesium oxide on amorphous -- on an
7 amorphous CoFeB ferromagnetic underlayer.
8 A I'm just going to give you the same
9 answer I gave before. It was known in the art
10 that the crystal -- the -- the well-oriented 001
11 CoFe -- MgO could be deposited on any amorphous
12 substrate. And there's literature showing that a
13 very thin layer, like the one shown in Figure 9,
14 could be grown with that well-oriented 001
15 texture. Now, I don't have a -- I don't have a
16 reference explicitly showing what you're asking
17 for, but I think it is well known to a person of
18 ordinary skill.
19 Q So you agree that there's nowhere in your
20 declaration where you cite a prior art example of
21 forming a polycrystalline magnesium oxide with a
22 preferential 001 orientation on an amorphous CoFeB
23 ferromagnetic underlayer?
24 A It's -- that is implied in the -- in the
25 art that I have cited.

1 Q Okay. Dr. Bokor, I don't want to talk
2 about implied. I don't want to talk about it
3 would have been known. I want to know exactly. I
4 want to know precisely. So let's just agree that
5 you have cited Exhibits 1097, Exhibit 1098, and
6 Exhibit 1099 as examples of forming magnesium
7 oxide on an amorphous material; correct?
8 A Those exhibits disclose as you described,
9 forming an MgO on an amorphous material.
10 Q And not one of those exhibits forms MgO
11 on amorphous cobalt iron boron; correct?
12 A Not explicitly.
13 Q Do they do it -- okay. Why are you
14 having trouble telling -- agreeing with the --
15 this statement that none of Exhibit 1097, 1098,
16 and 1099 describe forming magnesium oxide on
17 amorphous cobalt iron boron?
18 A I gave you the answer several times. It
19 is not explicitly in there. But that's -- that's
20 implied. And the reason -- I'm just going to go
21 out on a limb here and say the reason why I'm
22 emphasizing the point that it was well known in
23 the art that you could grow Mg -- MgO highly
24 oriented 001 on any amorphous substrate, including
25 amorphous CoFeB, is that the context that we have

1 here is the novelty of the -- of the patent, of
2 the Yuasa patent that is at issue here, the '167.
3 And so that's why I continue to try to make --
4 keep the record clear -- I'm saying this because
5 my opinion is that what's disclosed in the patent
6 in this regard is not novel.
7 Q Dr. Bokor, did you look for any prior art
8 example that expressly disclosed, explicitly
9 disclosed forming 001 magnesium oxide on amorphous
10 cobalt iron boron?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: Let me cite another
13 relevant example to your question, which you may
14 not like. But I'm going to cite it anyway. In
15 Parkin, Parkin discloses after an anneal, getting
16 crystallized cobalt iron boron adjacent to
17 crystallized MgO. Whether it is on the bottom or
18 the top, I don't think is depositive on the -- on
19 the issue at hand. So Parkin grew the MgO on
20 cobalt iron, not on CoFeB. But then he deposits
21 CoFeB on top, anneals it, and gets a crystal
22 structure. And he -- as we were discussing
23 earlier, he suggests in there that the -- that the
24 bottom layer could be amorphous CoFeB. Remember,
25 because the CoFeB -- that the layer -- the cobalt

1 iron boron may be included. It doesn't have to be
2 included. So I believe a person of ordinary skill
3 in the art reviewing Parkin can find all the
4 elements that led to, for example, the image in
5 Figure 9 of Exhibit 2005.
6 BY ATTORNEY WICHMAN:
7 Q Can you cite any example other than
8 exhibit -- your description of Exhibit 1062,
9 Parkin?
10 A That's the main thing that I relied on.
11 I don't have any other examples of that specific
12 thing to point to.
13 Q Okay. And then my question was, did you
14 actually look for examples of magnesium oxide with
15 001 texture formed on amorphous CoFeB in the prior
16 art?
17 A I can't recall how much prior art
18 searching I personally did. I probably -- I
19 did -- I will say I did not do what I would
20 consider an exhaustive search on my own to look
21 for that.
22 Q But it is your testimony that it was well
23 known in the art to form magnesium oxide with a
24 001 texture on amorphous CoFeB; right? That's
25 your testimony?

1 A That is my testimony.
2 Q All right. Well, if it is so well known,
3 why didn't you find examples of?
4 ATTORNEY ARNOLD: Objection. Form.
5 THE WITNESS: You know, that's -- I don't
6 know how to answer that question. Just because
7 something is well known doesn't mean that, you
8 know, people -- people go and publish. Not
9 everything that is known is publishable. Whether
10 or not someone knew that you could do that but
11 didn't publish it, you know, maybe they didn't
12 publish it. The point is that there's enough
13 prior art out there, you know, for the -- for the
14 matter that is really at issue in the discussion
15 that we have here today -- maybe it is, like, you
16 know, the elephant in the room -- whether or not
17 the -- the '167 patent is novel is what we're
18 really here talking about. Now, the fact that I
19 claim that all of the elements are -- were known
20 in the prior art, the fact that there isn't --
21 other than Parkin discloses all of those elements.
22 The fact that I don't have another reference to
23 put in front of me right now, I don't understand
24 the relevance of that actually to the discussion.
25 But the answer is I don't have another reference

1 like Parkin that has all of these elements in it.
2 But I think Parkin is sufficient.
3 BY ATTORNEY WICHMAN:
4 Q Okay. And when you formed this opinion
5 about Parkin, that it teaches forming magnesium
6 oxide with 001 texture on an amorphous CoFeB
7 ferromagnetic underlayer, did you consider the
8 disclosure in Exhibit 2079, at page 35, lines 10
9 through 18?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: Well, like I said, I did
12 read this article -- I did read this application
13 and I gave it some consideration at the time that
14 I read it, yes.
15 BY ATTORNEY WICHMAN:
16 Q So you agree that at page 35, lines 10 to
17 18, Parkin is describing, in fact, controlling the
18 texture of the lower ferromagnetic electrode by
19 controlling layer 112 and its texture, which in
20 turn controls the texture of the iridium-manganese
21 layer 116, which in turn controls the texture of
22 the lower ferromagnetic electrode; right?
23 ATTORNEY ARNOLD: Objection. Form.
24 THE WITNESS: This is -- this is a
25 different embodiment. So yeah, that -- he's

1 teaching that here. This is one -- one way to
2 make an MTJ. It is not the only way to make an
3 MTJ.
4 BY ATTORNEY WICHMAN:
5 Q Okay. So if we can go to page 36 of
6 Exhibit 2079.
7 A Okay.
8 Q At line 4.
9 A Okay.
10 Q He says by changing the texturing of the
11 iridium-manganese layer 116 from 100 to 111, the
12 TMR of the resulting MTJ is considerably reduced;
13 right?
14 A Right.
15 Q So a POSA would understand this as
16 meaning the choice of the texture of all of the
17 layers that control the texture of the
18 ferromagnetic underlayers is significant in
19 achieving high TMR; right?
20 ATTORNEY ARNOLD: Objection. Form.
21 THE WITNESS: Okay. So now you're
22 getting into a subtly. Let me deal with that. My
23 opinion about the oriented growth on any amorphous
24 substrate was on any -- if I wasn't clear about
25 that, let me -- let me now clarify. Give me a

1 moment.
2 Okay. Let me just state it this way: My
3 opinion is the highly oriented MgO 001 can be
4 grown on an amorphous substrate. Any amorphous
5 substrate. Silicon nitride, glass, amorphous
6 CoFeB. Now, if you grow the -- I was trying to
7 find an example. I don't have an example of
8 citation right in front of me. But I will say
9 that -- and clarify. Perhaps I may have said that
10 you could grow MgO highly oriented on any
11 substrate. Any amorphous substrate is a correct
12 description of my opinion. If you try to grow MgO
13 highly oriented on a crystalline substrate -- for
14 example, 111 oriented, as is being discussed here
15 in this Parkin application -- if you try to grow
16 MgO on 111, iridium manganese, that's not
17 surprising that the TMR is lower. In fact, if I
18 go a little further down in the application from
19 Parkin that you're referring to, go down to
20 line -- let's start at line 13 -- 12. Page 28.
21 Exhibit 2079.
22 BY ATTORNEY WICHMAN:
23 Q I think you mean page 36. The internal
24 page numbers.
25 A Yes. Thank you.

1 Q Okay.
2 A Page 36. "When the iridium manganese
3 layer grows in the 111 texture, the cobalt iron or
4 iron layer grown on top of the iridium manganese
5 layer grow bcc but are oriented in the 100
6 crystallographic direction. The MgO layer grows
7 in the 111 texture. The different texturing of
8 the MgO layer, whether 100 or 111 in the
9 underlying ferromagnetic electrode, whether 100 or
10 110, which is dependent on the layer onto which
11 the iridium manganese layer is grown, clearly
12 influences the magnitude of the TMR effect. Thus,
13 the 100 texturing of the MgO layer and underlying
14 ferromagnetic electrode can be very important in
15 forming MTJs with high TMR."
16 So if you grow the MgO on a 111
17 substrate, for instance, then the MgO layer
18 becomes textured in a different way than when you
19 grow it on an amorphous substrate. And that
20 reduces the TMR.
21 Q So at line 18 here, at page 36, you just
22 read, the 100 texturing of the underlying
23 ferromagnetic electrode can be very important in
24 forming MTJs with high TMR; right?
25 A Right.

1 Q And a POSA would have understood that the
2 texturing of the underlying ferromagnetic
3 electrode can be very important in achieving high
4 TMR; right?
5 ATTORNEY ARNOLD: Objection. Form.
6 BY ATTORNEY WICHMAN:
7 Q And did you take that into consideration
8 when you formed your opinion that Parkin taught
9 forming 100 MgO on an amorphous CoFeB layer?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: I had -- this statement in
12 the Parkin patent application, Exhibit 2079, that
13 particular fact was in my mind. I was well aware
14 that the texture of the underlying electrode can
15 be important. That doesn't say that, but --
16 but -- if the underlying electrode has amorphous
17 texture, then one can achieve high quality 100
18 texturing of the MgO grown on that layer. If you
19 grow on a 111 metallic crystal, then the 100
20 texturing can be degraded or -- let's just put it
21 that way. You may not get that highly desired 100
22 texturing if you grow on a 111 ferromagnetic
23 crystal layer. That much I was aware of when I
24 wrote my opinion in my declaration.
25

1 BY ATTORNEY WICHMAN:
2 Q Okay. And in this passage from page 36,
3 lines 4 to 19, Parkin is describing cobalt iron or
4 iron layers as ferromagnetic underlayers; right?
5 A True.
6 ATTORNEY ARNOLD: Objection. Form.
7 BY ATTORNEY WICHMAN:
8 Q Okay. Turn to page 40 of Exhibit 2079.
9 Paragraph starts on line 11. Second paragraph on
10 the page.
11 A Yes.
12 Q All right. So if you drop down to line
13 16, it says, "The MTJ devices used in the
14 collection of the data shown in Figure 4 have a
15 lower ferromagnetic electrode formed by a bilayer
16 of 8 angstroms of cobalt iron and 18 angstroms of
17 iron." Right?
18 A That's what it says.
19 Q It describes a CoFe layer 118; right?
20 A Yes.
21 Q All right. And an iron layer 119 at
22 lines 19 to 20; right?
23 A 18 to 20, but yes.
24 Q Line 19, "The iron layer 119 is used to
25 give higher TMR values." Do you see that

1 sentence?
2 A Yes.
3 Q Okay. So in this here, Parkin is
4 describing using cobalt iron or iron as a
5 ferromagnetic underlayer; right?
6 ATTORNEY ARNOLD: Objection. Form.
7 THE WITNESS: That's fair.
8 BY ATTORNEY WICHMAN:
9 Q Okay. He is not describing using
10 amorphous CoFeB; right?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: Right.
13 BY ATTORNEY WICHMAN:
14 Q Line 45. Sorry. Page 45. Paragraph
15 starts at line 19. That's the bottom paragraph.
16 A Okay. I'm there.
17 Q Okay. At the end of line 19, "It seems
18 clear that the layer or layers 112 are preferably
19 chosen so that the iridium manganese layer and the
20 ferromagnetic pinned layers grow textured in the
21 100 direction and that the ferromagnetic layer is
22 preferably formed in the bcc crystal structure."
23 Right?
24 A You read it correctly.
25 Q All right.

1 A 100 orientation. I think you might have
2 said something else --
3 Q All right.
4 A -- but that's -- I see that sentence.
5 Q All right. So Parkin is saying that the
6 ferromagnetic layers preferentially -- preferably
7 form in the bcc crystal structure; right?
8 ATTORNEY ARNOLD: Objection. Form.
9 THE WITNESS: In the specific embodiment
10 he is describing here, yes.
11 BY ATTORNEY WICHMAN:
12 Q Okay. So this example doesn't describe
13 using amorphous CoFeB as a ferromagnetic
14 underlayer, does it?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: As I testified earlier --
17 let's just put it this way: In this excerpt, I
18 only want to answer narrowly because I don't want
19 to provide a broader -- any broader interpretation
20 of this document. I'm going along with you on
21 taking excerpts and reading them and giving you
22 the simple interpretation of the excerpt. So no,
23 in this paragraph, CoFeB is not mentioned.
24 BY ATTORNEY WICHMAN:
25 Q And did you take that into consideration

1 when you formed your opinion that Parkin teaches
2 forming magnesium oxide with a 100 texture on
3 amorphous CoFeB?
4 ATTORNEY ARNOLD: Objection. Form.
5 THE WITNESS: Parkin discloses all sorts
6 of things in that patent. So the fact that he
7 discloses an embodiment as described here -- and
8 he does describe other embodiments in the
9 disclosure of that patent -- I took that into
10 consideration. But I also, you know, read the
11 whole patent and tried to understand everything
12 that was disclosed there.
13 BY ATTORNEY WICHMAN:
14 Q So at page 45 of Exhibit 2079, line --
15 I'm sorry. Page 46.
16 A 46.
17 Q So the paragraph continues over to the
18 next page.
19 A Right.
20 Q Okay. If you drop down to line 6.
21 A 6.
22 Q "Significantly enhanced TMR values
23 compared to those for prior art aluminum oxide
24 tunnel barriers are found only when the texture of
25 the ferromagnetic layer 119 and that of the

1 magnesium oxide tunnel barrier 120 prime is
2 predominantly 100." Right?
3 A You read it correctly.
4 Q Okay. And that's the only ferromagnetic
5 layer 119 that we have seen are described as iron
6 or a cobalt iron alloy; is that right?
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: When you say that we have
9 seen, what's the context? We have seen where?
10 BY ATTORNEY WICHMAN:
11 Q In these -- in these pages of the
12 application that we have been discussing.
13 A In the application. In this application.
14 Like I say, I would have to review the whole -- if
15 you ask me what appears in the entire application,
16 I would need time to review the whole application.
17 Right here in --
18 Q Go ahead. Go ahead.
19 A Right here in this particular text on
20 this page, cobalt iron boron is not mentioned. I
21 will agree to that.
22 Q Okay. And you agree that a ferromagnetic
23 layer textured in 100 orientation and formed in a
24 bcc crystal structure is not an amorphous
25 ferromagnetic underlayer; right?

1 ATTORNEY ARNOLD: Objection. Form.
2 THE WITNESS: Okay. I'll agree to that.
3 BY ATTORNEY WICHMAN:
4 Q Okay. So if we go back to Parkin,
5 Exhibit 1062. I just want to remind you where we
6 started here.
7 A Okay. I have it.
8 Q Yeah. Column 23 at PDF 32, the paragraph
9 starting at line 6. Right?
10 A Okay. Give me a moment. Paragraph --
11 column 23. Line -- what line?
12 Q 6.
13 A 6. Okay.
14 Q Do you see that paragraph there?
15 A I do.
16 Q All right. So the reason we've been
17 discussing this patent application is because
18 Parkin says, "Magnesium oxide tunnel barrier 540
19 that is shown in the embodiment in Figure 11 is
20 formed according to the methods described in
21 patent application 10/824,835." Right?
22 A That's what it says.
23 Q Okay. And we went through that
24 application. And that application describes
25 forming magnesium oxide on textured

1 polycrystalline or single crystal ferromagnetic
2 underlayers; right?
3 ATTORNEY ARNOLD: Objection. Form.
4 THE WITNESS: Right.
5 BY ATTORNEY WICHMAN:
6 Q Okay. So, Dr. Bokor, if we go back to
7 your declaration, Exhibit 1105, paragraph 35,
8 again, now at the bottom of this paragraph, you
9 say that the prior art Parkin patent, Exhibit
10 1062, previously disclosed CoFeB MgO MTJs. I want
11 you to tell me the factual basis that you relied
12 upon to reach that conclusion.
13 ATTORNEY ARNOLD: Objection. Form.
14 THE WITNESS: Well, I guess I think I've
15 been pretty clear in that all along. I'll try to
16 summarize. Parkin -- the Parkin patent discloses
17 CoFeB MgO MTJs. That's for sure. There's CoFeB.
18 And in the excerpt that we were looking at so
19 intensely, Parkin -- now I'm going to have a hard
20 time finding it. So you can -- you can -- we
21 can -- hold on. Okay. So going back to column 22
22 in Parkin, line 66, we've covered this before.
23 "An interface layer of crystalline cobalt iron
24 alloy may also be used." Let's go to the previous
25 sentence -- or the previous -- let's go back --

1 sorry. Let's start at line 6- -- 62. "In Figure
2 11 layer 515 of CoFeB is deposited which is
3 60 angstroms thick. Composition of the layer is
4 determined by RBS analysis," et cetera. Then an
5 interface layer 520 of crystalline cobalt iron
6 alloy may also be used.
7 So that's what I rely on to disclose
8 CoFeB MgO CoFeB. Now, we just had a long
9 discussion about whether -- about how to get 100
10 highly oriented crystal structure to get high TMR.
11 And Parkin -- I'm not going to take the time to go
12 look for it, unless you insist. Parkin discloses
13 crystallization of the CoFeB adjacent to
14 crystallized MgO. Here, he's disclosing putting
15 CoFeB on either side of the MgO. I've testified
16 that I have ample evidence that it was well known
17 in the art that you could get crystallized MgO
18 when deposited on amorphous CoFeB.
19 So you put all of that together, Parkin
20 discloses having CoFeB on either side of the MgO.
21 It is well known that you can get crystallized MgO
22 just depositing it on amorphous CoFeB. Parkin
23 teaches that if you have amorphous CoFeB adjacent
24 to crystallized MgO, at least a thin layer of the
25 CoFeB crystallizes at the interface. So that's

1 how I get all of the elements of CoFeB MgO MTJs
2 with the proper crystal structure to get high TMR.
3 That's my basis for my statement that you pointed
4 to in my declaration.
5 BY ATTORNEY WICHMAN:
6 Q So let me ask you this: If the sentence
7 in column 23 -- 22 of Parkin, at line 66, an
8 interface layer of a crystalline CoFe alloy may
9 also be used, were understood to refer to the
10 composition of the alloy and not the layer itself
11 being optional, would you still have the same
12 opinion that Parkin discloses forming MgO -- 100
13 MgO on amorphous CoFeB?
14 ATTORNEY ARNOLD: Objection. Form.
15 THE WITNESS: I'm sorry. Can you break
16 that down? You lost me.
17 BY ATTORNEY WICHMAN:
18 Q Let's do it this way. If -- in column 22
19 at line 26, if that --
20 A 26 or 66?
21 Q 66. Yeah.
22 A Okay.
23 Q If that sentence said a layer 520 of a
24 crystalline CoFe alloy is used instead of may also
25 be used, would your opinion change?

1 ATTORNEY ARNOLD: Objection. Form.
2 THE WITNESS: I don't know. I haven't --
3 I have not considered that possibility and I can't
4 give you an answer right -- you know,
5 extemporaneously.
6 BY ATTORNEY WICHMAN:
7 Q Let me ask it this way: Does your
8 opinion that Parkin teaches forming 100 textured
9 MgO on amorphous CoFeB depend on the proposition
10 that layer 520 is optional?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: I don't know. I would
13 have -- I haven't considered that question
14 specifically. And I would need time to consider
15 that. I would have to think about that.
16 BY ATTORNEY WICHMAN:
17 Q Okay. Please consider.
18 ATTORNEY ARNOLD: Objection. Form. Is
19 there a question pending?
20 THE WITNESS: I think I understand the
21 question.
22 BY ATTORNEY WICHMAN:
23 Q All right. Let's start over. The
24 question is, is it your opinion that -- does your
25 opinion that Parkin teaches forming 100 textured

1 magnesium oxide on amorphous CoFeB depend on the
2 proposition that layer 520 is optional?
3 ATTORNEY ARNOLD: Objection. Form.
4 THE WITNESS: No. I think there's other
5 support.
6 BY ATTORNEY WICHMAN:
7 Q So if layer 520 is not optional and
8 Figure 11 -- the Figure 11 embodiment that shows
9 an inverted device in which the storage electrode
10 is below the tunnel barrier layer and the
11 reference electrode is formed above the tunnel
12 barrier layer and the tunnel barrier layer is
13 formed on crystalline cobalt iron, where does
14 Parkin describe forming 100 magnesium oxide on
15 amorphous CoFeB?
16 ATTORNEY ARNOLD: Objection.
17 THE WITNESS: I think you've now narrowed
18 the question from -- from what I was considering.
19 If you insist that the bottom layer has to be
20 cobalt iron alloy instead of being optional, even
21 in the inverted configuration, then, yeah, I don't
22 know what to say. My opinion is that
23 CoFeB/MgO/CoFeB is sufficiently disclosed in this
24 Parkin patent. Now, if you say, well, let's
25 narrow in on a particular embodiment disclosed in

1 Parkin in which the underlayer is limited to
2 cobalt iron alloy, then obviously I can't claim
3 that therefore that discloses cobalt iron on both
4 sides. So if you say -- if you insist if I look
5 narrowly at a disclosure in Parkin where a cobalt
6 iron layer is -- is limited as the bottom layer,
7 then it doesn't disclose cobalt iron boron on both
8 sides. That's clear. That's obvious.
9 BY ATTORNEY WICHMAN:
10 Q You agree that Figure 11 is described as
11 an embodiment of -- of -- that inverts the device
12 in Figure 3A and Figure 3B; right?
13 ATTORNEY ARNOLD: Objection. Form.
14 THE WITNESS: Yes.
15 BY ATTORNEY WICHMAN:
16 Q In fact, it is right there in column 22,
17 at line 29. Figure 11 shows another
18 representative embodiment of the current invention
19 in which the structure of the device is shown in
20 Figures 3A and 3B is inverted; right?
21 A Right.
22 Q In Figure 11, if layer 520 is not option,
23 then you agree that Figure 11 does not describe
24 forming 100 magnesium oxide on amorphous CoFeB;
25 right?

1 ATTORNEY ARNOLD: Objection. Form.
2 THE WITNESS: Now you're saying
3 that Figure 11 -- if 511 has to be cobalt iron,
4 does 511 disclose CoFeB/MgO/CoFeB? I answer yes.
5 That is obvious. If you're insisting that the
6 bottom layer is CoFe, it can't be CoFeB.
7 BY ATTORNEY WICHMAN:
8 Q Okay. So tell me where else in Parkin is
9 there a disclosure of forming 100 magnesium oxide
10 on amorphous CoFeB?
11 A Well, in the inverted -- if you -- if you
12 exclude the inverted embodiment, then I'm not sure
13 I have a -- okay. Let me think about it.
14 Q Let me -- I think the transcription mixed
15 up some digits. Let's start over so that it is
16 clean here.
17 So in Figure 11, if layer 520 is not
18 optional, then you agree that Figure 11 does not
19 describe forming 100 magnesium oxide on CoFeB;
20 right?
21 ATTORNEY ARNOLD: Objection. Form.
22 THE WITNESS: Yes. I'll have to agree
23 with that.
24 BY ATTORNEY WICHMAN:
25 Q Okay. And so now the question is where

1 else in Parkin is there a disclosure of forming
2 100 magnesium oxide on amorphous CoFeB?
3 A Let me just interject. My answer to that
4 question the first time was I have not considered
5 that question. And it will take me a while to
6 review to answer a hypothetical which I now have
7 not considered before. And I told you that it
8 would take me a while to review the patent to try
9 to come up with a good answer to that question.
10 So I'm just -- I just wanted to repeat that and
11 make sure that you're willing to wait as long as
12 it takes for me to review the document and try to
13 come up with --
14 Q I understand. Let me ask it this way:
15 What else in Parkin -- okay. Strike that.
16 It's your testimony that Parkin discloses
17 forming 100 magnesium oxide on amorphous CoFeB;
18 right?
19 A In that Figure 11 that we were
20 discussing.
21 Q Okay. And if we exclude the idea that
22 layer 520 is optional, what else do you rely upon
23 as the basis of that opinion?
24 ATTORNEY ARNOLD: Objection. Form.
25 THE WITNESS: Right. And as I responded

1 earlier to this question, that's -- that's a
2 scenario that -- as I sit here right now, I don't
3 recall considering. And in order for me to
4 provide an answer for that, it will take me some
5 time to consider that hypothetical, which is new
6 to -- to my consideration.
7 BY ATTORNEY WICHMAN:
8 Q Let me ask it this way: You -- well, you
9 agreed that you formed this opinion. I want to
10 know what you relied upon to form that opinion,
11 other than the proposition that layer 520 is
12 optional?
13 ATTORNEY ARNOLD: Objection. Form.
14 THE WITNESS: So you're giving me a
15 hypothetical that I have not previously
16 considered. You know, I stopped. And when I
17 looked at that one, I could see, okay, right
18 there, that discloses growing the MgO directly on
19 the CoFeB. Now, are there other disclosures in
20 this patent that would suggest to a person of
21 ordinary skill growing MgO on top of CoFeB, I
22 have -- I have to review it. I don't have it in
23 front of me.
24 BY ATTORNEY WICHMAN:
25 Q I think we're missing each other here.

1 I'm not asking you to form a new opinion. I want
2 to know how you arrived at the opinion that you
3 offered. And it sounds like what you're saying is
4 your opinion is based on the idea that layer 520
5 is optional. Is that right?
6 A That --
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: That certainly provides a
9 basis for my opinion. Now, I don't want to sit
10 here and let you put words in my mouth where I say
11 there's no other evidence for the proposition that
12 this patent discloses growing 100 oriented MgO on
13 CoFeB.
14 BY ATTORNEY WICHMAN:
15 Q Okay. Dr. Bokor, the deposition is not
16 the time to adduce new evidence. I'm asking you
17 for the basis of the testimony that you offered.
18 And when you offered that testimony, you had to
19 have some reason to come to your conclusion. And
20 the purpose of this examination is to identify how
21 you arrived at that conclusion. So I want to know
22 what you took into account when you formed that
23 opinion. I'm not asking you to go through and
24 find some new basis to support that opinion. I
25 mean, you signed this declaration; right?

1 A Yes.
2 Q And you signed it under penalty of
3 perjury, didn't you?
4 A Yes.
5 Q These are your opinions; right?
6 A Yes.
7 Q You didn't let the lawyers for Western
8 Digital put these words in your mouth; right?
9 A Of course not.
10 Q And so you formed -- you formed a
11 considered opinion; right?
12 A I did.
13 Q And when you -- when you formed that
14 opinion, you relied on the evidence; right?
15 A Right.
16 Q And there are -- there are things in the
17 evidence that led you to your conclusion; right?
18 A Correct.
19 Q And now I'm asking you to tell me what
20 are the things that led you to this conclusion,
21 other than you already told us that you think
22 layer 520 is optional.
23 A And what I'm saying is I -- I very well
24 may have other evidence for that when I wrote --
25 when I signed the declaration. But I don't recall

1 right as I sit here what other evidence there may
2 have been or there was. Because I had this solid
3 piece of evidence right there about layer 520. So
4 I looked at that. Boom. That's enough. Now, I
5 didn't write in my declaration a list of all of
6 the -- all of the evidence that I have for this
7 statement that we've been talking about all
8 morning in paragraph -- paragraph 30 -- 35. I
9 didn't -- I didn't write all of the -- I didn't
10 detail all of the considerations that I took into
11 account to write that statement. And I don't
12 remember all of the considerations that I took
13 into account when I wrote the simple statement
14 that the prior art Parkin patent discloses CoFeB
15 MgO MTJs. You asked me for evidence. The
16 discussion around Figure 11 I think is sufficient.
17 However, there may well be other evidence in there
18 that I'm just not remembering as I sit here right
19 now.
20 Q And when you --
21 A I'm not -- I'm not -- I'm not saying that
22 I need to look for new evidence. I -- I reviewed
23 this patent carefully. But, you know, I reviewed
24 a lot of documents. I -- there's a lot of
25 information in this patent. And prominent in my

1 mind is Figure 11. But sitting here right now, I
2 can't answer the question about what else I may
3 have relied on for the conclusionary statement
4 that was in my declaration.
5 Q Okay. Dr. Bokor, in paragraph 35 of your
6 declaration, when you refer to CoFeB MgO MTJs, is
7 that a magneto-tunnel junction that has
8 crystallized CoFeB ferromagnetic electrodes?
9 ATTORNEY ARNOLD: Objection. Form.
10 THE WITNESS: Yes.
11 BY ATTORNEY WICHMAN:
12 Q Okay. And in Parkin, column 22, which is
13 PDF 31, at line 51 -- just let me know when you're
14 there.
15 A Column 22?
16 Q 22, yeah?
17 A Line 51.
18 Q Yeah. Are you at line 51?
19 A I am.
20 Q Okay.
21 A I'm looking --
22 Q Do you see where it says, "It is also
23 preferred that the underlayer have an amorphous or
24 polycrystalline fine grain structure so that the
25 crystallization of the amorphous layer 515

1 comprising the reference ferromagnetic electrode
2 deposited on the underlayer 512 is not
3 encouraged"? Did I read that correctly?
4 A You read it correctly. Now I'm -- now
5 I'm considering it.
6 Q So did you take that sentence into
7 account when you formed the opinion that Parkin
8 describes forming 100 textured magnesium oxide on
9 crystallized cobalt iron boron ferromagnetic
10 underlayers?
11 A Yeah. I -- I can give you a consistent
12 explanation of that.
13 Q You took that sentence into
14 consideration?
15 A Yes.
16 Q Okay. What's your explanation,
17 Dr. Bokor?
18 ATTORNEY ARNOLD: Objection. Form.
19 THE WITNESS: In Parkin, he discloses
20 elsewhere -- and I can find it if you -- if you
21 want to wait for that. But I think you probably
22 are already aware. Parkin teaches that amorphous
23 CoFeB in contact with crystallized MgO forms a
24 thin crystallized layer at the interface. He also
25 says, though, that -- that for other reasons, the

1 ferromagnetic layers -- it is preferred for the
2 ferromagnetic layer to have amorphous structure
3 because of uniformity and a variety of secondary
4 kind of considerations. So what Parkin is doing
5 in this patent is he's kind of trying to teach
6 something that is a little bit subtle. The
7 subtle -- the subtly is that the ferromagnetic
8 layers -- for a variety of reasons, the
9 ferromagnetic layer not being crystallized has an
10 advantage. In terms of the -- I think it is
11 the -- some of the other magnetic properties. It
12 will take me a moment, you know, to find that part
13 of the patent. The ideal structure from Parkin's
14 point of view is an amorphous ferromagnetic layer
15 with a thin crystalized layer adjacent to the MgO.
16 You need the crystallized ferromagnetic layer
17 close to the MgO to get the advantage -- to get
18 the high TMR because as is shown -- as is shown in
19 Butler, the crystal structure of the ferromagnet
20 has a key role in the TMR. So the ideal structure
21 taught here in Parkin is to have a thin -- have a
22 thin crystallized ferromagnet layer adjacent to
23 the crystallized MgO. But for other reasons, it's
24 good -- it's better to have the electrode
25 amorphous. So the optimization is to have a thin

1 crystallized ferromagnetic layer, but not have it
2 be crystallized to a high -- to -- to a very
3 thick -- to high thickness, large thickness. So
4 what -- the way I -- when I -- the consideration I
5 have in looking at this is that the -- the
6 crystallization of the underlayer is not
7 encouraged. You want to maintain that layer as
8 mostly amorphous. But the understanding that
9 Parkin has -- we just were looking at it in that
10 patent application that you -- that we spent so
11 much time on. It's important that the
12 ferromagnetic layer be crystallized right adjacent
13 to the MgO in order to get the advantage of the
14 coherent injection of electrons into the MgO. So
15 that's -- that's the way I understand this -- this
16 statement.
17 BY ATTORNEY WICHMAN:
18 Q So it is not only important that the
19 ferromagnetic electrode be crystallized 100, but
20 also that the magnesium oxide at that interface is
21 crystallized or has a 100 texture; correct?
22 A That's correct.
23 Q Right at the interface?
24 A Right at -- well, the MgO should be
25 crystallized ideally all the way through. It is a

1 thin layer, only one or two nanometers thick. The
2 MgO ideally -- now, the patent -- Parkin does not
3 require the MgO to be crystallized all the way
4 through, just -- in my opinion. But yes, the MgO
5 should be substantially crystallized.
6 ATTORNEY WICHMAN: All right, Dr. Bokor.
7 It's -- I think it is 12:20 your time.
8 THE WITNESS: It is.
9 ATTORNEY WICHMAN: Why don't we take 31
10 minutes for lunch and come back. Would that be
11 sufficient?
12 THE WITNESS: 31 minutes.
13 ATTORNEY WICHMAN: So come back at ten
14 till, ten to the hour. Do you need more time?
15 THE WITNESS: It is a little tight. I
16 could use a little bit -- a longer break.
17 ATTORNEY WICHMAN: How about the top of
18 the hour. That's 40 minutes. Is that enough
19 time?
20 THE WITNESS: 40 minutes. Let's go with
21 that.
22 ATTORNEY WICHMAN: All right. It will be
23 1:00 your time and 4:00 my time.
24 THE WITNESS: Okay.
25 ATTORNEY WICHMAN: All right. Thanks.

1 Off the record.
2 (A recess was taken.)
3 ATTORNEY WICHMAN: On the record.
4 Q Dr. Bokor, during our break, did you
5 discuss this deposition with anyone?
6 A No.
7 Q Can you open Exhibit 2022, from the 1493
8 case.
9 A Book by Duke.
10 Q Exhibit 2022 is a paper entitled "Read
11 sensor technology for ultrahigh density magnetic
12 recording."
13 A Oh, I'm sorry. I opened the wrong one.
14 I opened 2022. Nakatani.
15 Q Okay. All right. You see that this
16 paper, at page 106, which is PDF page 1, the first
17 two authors are Tomoya Nakatani and Zheng Gao;
18 right?
19 A Yes.
20 Q And the affiliation at the bottom of this
21 page lists Zheng Gao as Recording Head Development
22 Group, Western Digital Corporation; right?
23 A I see that.
24 Q If you turn to page 111, which is PDF 6,
25 there's two biographical blurbs for these authors;

1 right?
2 A There are three authors, three blurbs.
3 Yeah.
4 Q It says that Zheng Gao, she was a global
5 director in the Recording Head Development Group
6 at Western Digital; right?
7 A I see that.
8 Q And then in Tomoya Nakatani's biography,
9 he says that after completing his post-doctoral
10 research at NIMS, the National Institute for
11 Materials Science, Japan, he joined HGST which in
12 parenthesis is currently Western Digital
13 Corporation as a principal research engineer in
14 2012. Right?
15 A That's what it says.
16 Q So that was his affiliation before he
17 became a senior researcher at the National
18 Institute of Materials Science in Japan; right?
19 A That's what it says, yeah.
20 Q All right. If you can go to page 107,
21 PDF 2. On the right-hand column, bottom
22 paragraph. It starts with Djayaprawira again.
23 A I see that.
24 Q And there's some endnotes 10. If you go
25 to page 110, PDF 5, you will see that reference 10

1 is the Yuasa 2005 APL paper; right?
2 A I see that.
3 Q All right. Back to page 107, PDF 2,
4 bottom right column. It says that Djayaprawira
5 reported in 2005 an even higher TMR ratio of 230
6 percent with a CoFeB/MgO/CoFeB MTJ; right?
7 A I see that.
8 Q That is the CoFeB/MgO/CoFeB MTJ described
9 in Yuasa's 2005 Applied Physics Letter paper;
10 right?
11 A Right.
12 Q Then here in Exhibit 2022, they go on to
13 say that the significance of this work was not
14 only the high MR ratio, but also it was a fully
15 integrated film directly produced from sensor
16 deposition sputtering tool; right?
17 A That's correct.
18 Q And a POSA would have understood that the
19 technique described in Yuasa's APL 2005 performing
20 a CoFeB/MgO/CoFeB MTJ was consistent with
21 providing a fully integrated film directly
22 produced from sensor deposition sputtering tools;
23 right?
24 ATTORNEY ARNOLD: Objection. Form.
25 THE WITNESS: I think that is probably

1 correct.
2 BY ATTORNEY WICHMAN:
3 Q Okay. The paper goes on, "Instead of a
4 single crystalline or polycrystalline
5 ferromagnetic layer, amorphous (A-CoFeB) was used
6 to promote strong 001 magnesium oxide texture in
7 the as deposited state. Post-anneal transforms
8 amorphous CoFeB layer from amorphous to 001
9 textured polycrystalline CoFe layer templated from
10 the 001 MgO layer, giving rise to this orientation
11 relationship with the 001 texture in each grain."
12 Right?
13 A You read it correctly.
14 Q Okay. And a POSA would have agreed with
15 this description of the CoFeB/MgO/CoFeB MTJ
16 fabrication method described in Yuasa 2005 APL;
17 right?
18 ATTORNEY ARNOLD: Objection. Form.
19 THE WITNESS: Okay. I'll -- I'll agree
20 with that.
21 Did you not hear me?
22 BY ATTORNEY WICHMAN:
23 Q No. I did. I'm preparing my next
24 question for you.
25 A No problem. Take your time. I wanted to

1 make sure. Last time, if you remember, we had a
2 little trouble with the volume. That's all.
3 Q Okay. So you agree that the significance
4 of Yuasa's work in the 2005 APL paper was that it
5 was a fully -- it provided a fully integrated film
6 directly produced from his sensor deposition
7 sputtering tool using amorphous CoFeB to promote
8 strong 001 magnesium oxide texture in the -- as
9 deposited state; right?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: Okay.
12 BY ATTORNEY WICHMAN:
13 Q Okay. If you could open Exhibit 2023
14 from the 1493 case, please.
15 A So this is -- I think I have it. It's
16 a -- first author is Jang. Journal of Magnetism
17 and Magnetic Materials.
18 Q Yes. The title of the article is
19 Tunneling magnetoresistive devices as read heads
20 in hard disk drives.
21 A Yes, I see that.
22 Q Okay. And do you see that underneath the
23 authors, the affiliation is identified as Headway
24 Technologies, a TDK Group Company?
25 A Yes, I see that.

1 Q Are you familiar with TDK in 2023?
2 A Generally.
3 Q What is TDK?
4 A Well, it's a company that was involved
5 in -- I think -- so I don't know -- I don't know
6 in detail all of the different businesses that was
7 in. But I know that they were in the hard disk
8 drive business.
9 Q And they used MTJs?
10 A You know, I don't know that personally
11 for a fact. It seems like a reasonable
12 assumption. But we shouldn't be dealing in
13 assumptions here. So I think my correct answer
14 for that is I don't know.
15 Q Okay. Can you turn to page 2, which
16 should be PDF 2. Starting at the bottom of the
17 left column.
18 A On the left. Okay.
19 Q See the last sentence says, "Additional
20 novel ideas laid the foundation of subsequent
21 experimental work"? Do you see that?
22 A Okay. I see that.
23 Q And this is in a section 2 TMR film
24 evolution.
25 A Okay.

1 Q And so the first experimental work that
2 they point to is Yuasa's 2004 Nature Materials
3 paper, right, where he was reporting the results
4 of single crystal iron/magnesium oxide/iron MTJs;
5 is that right?
6 A I think you blanked out there. I didn't
7 -- did you say something? Now I hear you.
8 Q All right. On the -- at the bottom of
9 the left column, page 2, Exhibit 2023, explaining
10 TMR film, they write, "Additional novel ideas laid
11 the foundation of subsequent experimental works."
12 Right?
13 A Right.
14 Q The first idea they point to is Yuasa's
15 2004 work with single crystal iron/magnesium
16 oxide/iron MTJs; right?
17 A Yes.
18 Q Then the second example they show is
19 Parkin's work with 001 cobalt iron/magnesium
20 oxide/cobalt iron MTJs; right?
21 A Right.
22 Q And then the third example they cite, "In
23 particular, Djayaprawira obtained 230 percent TMR
24 with sputtered CoFeB/magnesium oxide/CoFeB MTJs."
25 Right?

1 A Right.
2 Q At the end of that discussion, there's a
3 cite to reference 20; right?
4 A Farther down. I see the 20.
5 Q Further down. The 20. And if you turn
6 to page 7, PDF 7, you will see reference 20 is
7 Yuasa's 2005 APL paper; right?
8 A Yeah. The Djayaprawira paper.
9 Q Yes. Okay. Back to page 2, the top
10 right paragraph. Describing this Yuasa 2005 APL
11 paper, these authors write, "Their results are of
12 significant technology importance for the magnetic
13 recording head industry because they deposit" --
14 A I'm sorry. I'm just going to stop you.
15 I'm not -- I haven't caught up with you.
16 Q Sorry?
17 A "Their results are of significant
18 technology importance"?
19 Q Yes. So they write, "Their results" --
20 their results meaning Yuasa 2005 Applied Physics
21 Letter paper.
22 A Yes.
23 Q Okay. "Their results are of significant
24 technology importance for the magnetic recording
25 head industry because they deposited MTJs with

1 standard spin valve structure technology performed
2 at room temperature." Correct?
3 A You read it correctly.
4 Q Do you agree with that statement?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: What I'm hesitating on is I
7 believe that when he says their results, I think
8 that -- I think that includes the Parkin ref 19.
9 Sorry. Yeah. Parkin 19. And then Djayaprawira
10 20. It is a little ambiguous, but it seems to me
11 that they're referring to both.
12 BY ATTORNEY WICHMAN:
13 Q All right. The next sentence says, "They
14 used a conventional sputtering method instead of
15 an MBE system and they achieved a giant TMR ratio
16 with simple amorphous CoFeB ferromagnetic
17 electrodes instead of strenuously high temperature
18 deposition with single crystalline structures."
19 Right?
20 A That's correct. You read it correctly.
21 Q And you're telling me that the they in
22 that sentence refers to Parkin as well as Yuasa
23 2005 APL?
24 A I would have to look at Parkin. I think
25 Parkin discloses something very similar to that.

1 Q Well, there's an endnote at the end of
2 the sentence that I just read. Endnote 20; right?
3 A Okay. Okay. Okay. So this sentence is
4 referring to -- okay. You're right. This
5 sentence is referring to 20.
6 Q Okay. And their results in the previous
7 sentence is also referring to 20; right? It is
8 the same pronoun, they.
9 A Okay. So I don't have reference 19
10 Parkin handy. I don't recall even if it is in the
11 record for this case. But from what I know about
12 Parkin's work, I believe that the statement --
13 first of all, significant technology importance.
14 Certainly Parkin was using standard spin valve
15 structure technology. Conventional sputtering
16 method instead of MBE, I think that also applies
17 to Parkin. Giant TMR with amorphous CoFeB, I
18 think -- I think that applies also in the Parkin
19 reference 19. And certainly the technology
20 transition from aluminum oxide to the MgO barrier
21 layer was much easier. So I suspect that this --
22 that these statements, when they -- they say
23 they -- and you're right, the 20 is just at the
24 end of that sentence. But I -- I strongly suspect
25 and -- you know, I would want to review reference

1 19 to be certain. I strongly suspect that ref 19
2 has all of these same attributes.
3 Q All right. Dr. Bokor, the next sentence
4 says, "Their work made the technology transition
5 from aluminum oxide to magnesium oxide barriers
6 much easier thanks to the use of simple CoFeB
7 amorphous magnetic electrodes to preserve
8 magnesium oxide structure from being impacted by
9 fcc underlayers and free layer structures."
10 Correct?
11 A That's what it says.
12 Q And if you go back -- one, two -- three
13 sentences, they just described Yuasa's APL -- 2005
14 APL as describing sputtered CoFeB/magnesium
15 oxide/CoFeB MTJs; right?
16 A Yeah. And what I'm -- that's what they
17 say. But what I'm saying is I don't have that
18 Parkin reference right in front of me. That's
19 different from the patent that we were reviewing a
20 little while ago, this reference 19 Parkin. And
21 to the best of my recollection, Parkin had
22 CoFeB/MgO/CoFeB in that paper. But I can't
23 confirm that without reviewing it. So I think it
24 is arguable here whether or not the Yuasa paper
25 is -- singularly has all of these attributes that

1 are being mentioned here. And a person of
2 ordinary skill reading this I think would also
3 have -- it's -- it's arguably ambiguous when they
4 say they.
5 Q Dr. Bokor --
6 A They is plural. They could include the
7 Parkin reference. And I -- just right now,
8 sitting here right now, I would need some time to
9 review to resolve in my mind whether they refers
10 exclusively and limited to the reference 20 or
11 also includes reference 19.
12 Q Dr. Bokor, the authors write that Parkin
13 showed 220 percent and left out the TMR in highly
14 oriented 001 cobalt iron, magnesium oxide, cobalt
15 iron mag- -- magnetotunnel junctions. Right?
16 A Okay.
17 Q Are you telling me it's your testimony
18 that when these authors three sentences later
19 describe the use of simple CoFeB amorphous
20 magnetic materials, that they are referring to a
21 paper that they just described as forming MTJs
22 with cobalt iron and not a -- not amorphous CoFeB?
23 A No. You're right. I -- I agree with
24 you.
25 Q Okay. So this sentence, their work made

1 the technology transition, that's referring to
2 Yuasa's 2005 APL paper.
3 A Okay. I stand corrected. I --
4 Q Okay. And so this -- this whole sentence
5 here, "Their work made the technology transition
6 from aluminum oxide to magnesium oxide barrier
7 much easier thanks to the use of simple CoFeB
8 magnetic electrodes to preserve magnesium oxide
9 structure from being impacted by fcc underlayers
10 and free layer structures." Do you agree with
11 that statement?
12 ATTORNEY ARNOLD: Objection. Form.
13 Objection. Form.
14 THE WITNESS: Okay. Yeah. I'll agree
15 with that.
16 BY ATTORNEY WICHMAN:
17 Q Okay. And then upon annealing the CoFeB
18 and magnesium oxide can be crystallized to bcc
19 structures; right? And you agree that that is
20 shown in Yuasa's APL 2005 paper?
21 ATTORNEY ARNOLD: Objection. Form.
22 THE WITNESS: In the paper, yes.
23 BY ATTORNEY WICHMAN:
24 Q Do you disagree that it is claimed in the
25 '167 patent?

1 A I do.
2 Q The '167 patent, claim 1, element 1A is
3 forming a first CoFeB layer that is amorphous;
4 correct?
5 A Hang on. Let me get to the patent.
6 Q Let me ask the question this way,
7 Dr. Bokor: Do you agree that the statement, "Upon
8 annealing CoFeB and magnesium oxide can be
9 crystallized to bcc structures" describes a first
10 and second amorphous CoFeB layer as crystallized
11 by annealing?
12 ATTORNEY ARNOLD: Objection. Form.
13 THE WITNESS: Just bear with me. I'm
14 just trying to organize the exhibits on my screen
15 so I can easily go back and forth.
16 All right. So please ask your question
17 one more time.
18 BY ATTORNEY WICHMAN:
19 Q Okay. Dr. Bokor, do you agree that the
20 statement, "Upon annealing CoFeB and magnesium
21 oxide" -- okay. Strike that.
22 They're -- they're describing Yuasa's
23 2005 APL paper with CoFeB/magnesium oxide/CoFeB
24 MTJs here in Exhibit 2023, page 2, at the top
25 right column; is that right?

1 A Okay.
2 Q And you agree that when they say, "Upon
3 annealing CoFeB and MgO can be crystallized to bcc
4 structures," that that describes a first and
5 second CoFeB layer being crystallized upon
6 annealing?
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: You're asking if the
9 sentence in this article is describing
10 crystalizing CoFeB and MgO upon annealing? That's
11 the question?
12 BY ATTORNEY WICHMAN:
13 Q I just asked you about the CoFeB layers.
14 A Okay. The sentence in this article, I
15 agree that's what it's describing.
16 Q Okay. Can you turn to Exhibit 2029.
17 A 2029.
18 Q Actually, let's change that. Can you
19 open Exhibit 2024.
20 A 2024. Okay. Japan Society of Applied
21 Physics Achievement Award Recipients?
22 Q Right. And if you go to PDF page 3,
23 where it -- at the bottom, internal page --
24 internal page number 2. At the bottom, there's a
25 header that says 23rd Japan Society of Applied

1 Physics Achievement Award Research Achievement.
2 A I see that.
3 Q And the winner is Shinji Yuasa?
4 A I see that.
5 Q And the subject is pioneering research on
6 magnesium oxide magnetic tunnel junctions;
7 correct?
8 A I see that.
9 Q All right. If you turn to the next
10 page -- so it is PDF 4, internal page 3 -- do you
11 see where it says, "Shinji Yuasa invented MTJs
12 combining magnesium oxide and cobalt iron boron
13 (CoFeB) alloys in collaboration with Canon Anelva,
14 and developed a process that enabled device
15 fabrication on arbitrary underlying layers. This
16 structure and process enabled mass production on
17 large diameter wafers by room temperature sputter
18 deposition which opened the door to industrial
19 applications of magnesium oxide MTJ devices." Did
20 I read that correctly?
21 A Yes.
22 Q Do you agree that the process of forming
23 CoFeB/magnesium oxide/CoFeB MTJs described in
24 Yuasa's 2005 APL paper enabled mass production on
25 large diameter wafers by room temperature sputter

1 deposition?
2 A I'll agree that the paper contributed to
3 that.
4 Q Do you agree that that consequence opened
5 the door to industrial applications of MgO MTJ
6 devices?
7 A It contributed toward opening the door to
8 industrial applications, yes. I agree with that.
9 Q Do you agree that the CoFeB -- the
10 process of making CoFeB/magnesium oxide/CoFeB MTJs
11 described in Yuasa's 2005 Applied Physics Letter
12 paper enabled device fabrication on arbitrary
13 underlying layers?
14 A I will agree with that.
15 Q Okay. We can set that aside.
16 So I think let's look at Exhibit 2029.
17 A 2029. All right. I have it.
18 Q Okay. So this is a press release
19 concerning AIST wins three science and technology
20 awards in the 2016 Minister of Education, Culture,
21 Sports, Science and Technology, Accommodation for
22 Science and Technology; is that right?
23 A I see that.
24 Q All right. If you turn to PDF page 2, it
25 should be internal page 2 as well. At the bottom,

1 do you see that there's a reference to AIST
2 Spintronics Research Center, Director Shinji
3 Yuasa?
4 A I see that.
5 Q Okay. Do you see that in the second
6 paragraph there, "Furthermore, in collaboration
7 with a manufacturing equipment manufacturer, mass
8 production technology was developed that combines
9 magnesium oxide and the magnetic alloy CoFeB
10 making industrial applications of magnesium oxide
11 tunnel magnetoresistance elements possible"? Do
12 you see that?
13 A I'm just catching up. You started -- and
14 now I see you started reading in the middle of the
15 paragraph.
16 Q The sentence that starts "furthermore."
17 A Furthermore. Okay. It took me a while
18 to catch up to you because I thought you were
19 starting at the beginning of the paragraph. Okay.
20 So -- I agree with that sentence.
21 Q Do you agree that the CoFeB/magnesium
22 oxide/CoFeB device and the process for making it
23 described in Yuasa's 2005 APL paper provided mass
24 production technology or was amenable to mass
25 production technology -- well, let me strike that.

1 Do you agree that the process for making
2 CoFeB/magnesium oxide/CoFeB described in Yuasa's
3 2005 Applied Physics Letter -- Letters paper
4 provided for developing mass production technology
5 that combines MgO in the magnetic alloy CoFeB and
6 made industrial applications of MgO tunnel
7 resistance elements possible?
8 ATTORNEY ARNOLD: Objection. Form.
9 THE WITNESS: I'll agree with that.
10 BY ATTORNEY WICHMAN:
11 Q Okay. You can put that aside. Can you
12 open Exhibit 2006, please.
13 A I have it.
14 Q Okay. We set that to the side for a
15 moment and go back to your declaration. So
16 Exhibit 1105, paragraph 7.
17 A 1105. That's my declaration?
18 Q It's your reply declaration.
19 A Where do you want me to go?
20 Q Paragraph 7.
21 A 7. 7. Okay.
22 Q You testified that Dr. Yuasa confirmed
23 that a skilled artisan knew magnesium oxide would
24 form as magnesium -- magnesium oxide 001 when
25 grown on an amorphous substrate; correct?

1 A Correct.
2 Q Is it your opinion that Exhibit 2006 is
3 prior art to the '167 patent?
4 A No.
5 Q Is it your opinion that Exhibit 2006 is
6 prior art to the '134 patent?
7 A No.
8 Q Okay. In Exhibit 2006, page 2 should be
9 PDF 3.
10 A So we're going back to -- now we're going
11 back to 2006?
12 Q Yes.
13 A All right. Okay. Page 2.
14 Q Page 2, which is PDF 3.
15 A Okay.
16 Q Are you there?
17 A Yeah.
18 Q Left-hand column.
19 A All right.
20 Q The last line left-hand column, just
21 above Figure 2. "Surprisingly, the MgO layer
22 grown on the amorphous CoFeB layer showed a good
23 crystalline structure with a 001 fiber texture."
24 Correct?
25 A You read it correctly.

1 Q "The lattice image of MgO 001 could be
2 clearly identified from the lower interface to the
3 upper interface, indicating that the MgO 001
4 texture developed from the initial stage of
5 growth." Correct?
6 A You read it correctly.
7 Q Okay. How can you say that Dr. Yuasa in
8 this paper confirmed that a skilled artisan knew
9 magnesium oxide would form as MgO 001 when in the
10 paper Dr. Yuasa says this was surprising?
11 A Well, I can't explain why he used the
12 word surprisingly given the rest of the paragraph
13 and the citation to reference 14.
14 Q Reference 14 concerns magnesium oxide
15 layers grown on amorphous silicon nitride;
16 correct?
17 A Correct.
18 Q But Dr. Yuasa is referring to magnesium
19 oxide grown on amorphous CoFeB; correct?
20 A Correct.
21 Q So Dr. Yuasa regarded those as different
22 things; correct?
23 A I can't -- I can't read the mind of
24 Dr. Yuasa. I can't get into what he is thinking.
25 I don't understand his use of surprisingly there.

1 And I don't -- I can't -- I can't get into his
2 head to figure out what he thought.
3 Q But we can agree that he said
4 surprisingly?
5 A He said that.
6 Q He regarded this as surprising?
7 A My opinion is that a person of ordinary
8 skill in the art would not. That's why --
9 Q I want to talk -- I want to talk about
10 the article.
11 A Let me finish.
12 ATTORNEY ARNOLD: Dr. Bokor gets to
13 finish his answer.
14 THE WITNESS: My opinion is that one of
15 ordinary skill in the art would not think that was
16 surprising. Further, obviously Dr. Yuasa was a
17 person of ordinary skill in the art. So that's my
18 basis for saying I don't understand the word
19 surprisingly here. I -- well, I kind of
20 understand the word surprisingly because when
21 people write papers, they like to try to, you
22 know, highlight what they want readers to look at,
23 what they want reviewers to pay attention to. So,
24 you know, he used the word surprisingly to try to
25 paint this result in as a favorable light as he

1 possibly could. That's what we all do. I don't
2 criticize him for that. But in my opinion, it
3 wasn't surprising. And he -- I suspect he in his
4 heart knew that. But I -- I'm only speculating.
5 BY ATTORNEY WICHMAN:
6 Q Dr. Bokor, we can agree that he used the
7 word surprisingly. We can at least agree on that?
8 A I've agreed with that a couple times now.
9 Q Okay. In your testimony, you say that he
10 confirmed the result that -- that a skilled
11 artisan knew magnesium oxide would form as MgO 001
12 when grown on amorphous substrate. And he just
13 said it was surprising that MgO 001 grew on
14 amorphous CoFe; correct?
15 A We've -- I think that mischaracterizes.
16 ATTORNEY ARNOLD: Objection.
17 THE WITNESS: Sorry.
18 I think that mischaracterizes the
19 discussion that we've been having, yes.
20 BY ATTORNEY WICHMAN:
21 Q Whether you agree with the word
22 surprisingly or not, how can you say that
23 Dr. Yuasa confirmed the expectations of a skilled
24 artisan that what Dr. Yuasa described as
25 surprising a skilled artisan would have expected?

1 ATTORNEY ARNOLD: Objection. Form.
2 THE WITNESS: I think I already answered
3 that. I don't -- I cannot explain -- I don't
4 understand -- I can't give you an explanation of
5 why he used the word surprisingly. Keep in mind,
6 my reference goes beyond 14. We talked before
7 lunch about other references that stated that you
8 could get this behavior on any amorphous
9 substrate, not just silicon nitride. It happened
10 on glass. So that's why I don't find it
11 surprising. In my opinion, a person of ordinary
12 skill in the art would not find it surprising.
13 And I cannot objectively explain to you -- you
14 would have to ask him why he used the word
15 surprisingly. I can't explain it.
16 BY ATTORNEY WICHMAN:
17 Q I'm asking you why you used the word
18 confirmed.
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: Why I used the word
21 confirmed. Can you remind me --
22 BY ATTORNEY WICHMAN:
23 Q Paragraph 7 of your declaration. First
24 sentence.
25 A Oh, my declaration. Paragraph 7. Okay.

1 Well, again, now that -- I'm not sure
2 whether you're asking me again to get behind
3 the -- why I used the word confirmed is that the
4 sentence in the paper says MgO layer grown on
5 amorphous silicon nitride substrates by ion beam
6 deposition is also 001 textured right at the
7 inception of the deposition. So his result --
8 for -- on CoFeB confirms that this was expected.
9 That's what I -- that's what I mean. So I said
10 that --
11 Give me a moment. Let me organize my
12 thing -- my thoughts.
13 So what I'm saying is the way I read the
14 sentence, note that MgO layer grown on amorphous
15 silicon nitrate substrates by ion beam assistive
16 deposition is also 001 textured right at the
17 inception of the deposition, I read that that
18 the -- his result on CoFeB confirms that
19 expectation. That's -- that's simply the way I
20 read it.
21 Q And why was he surprised?
22 ATTORNEY ARNOLD: Objection. Form.
23 THE WITNESS: You will have to ask him.
24 I can't answer that question.
25

1 BY ATTORNEY WICHMAN:
2 Q I'm just wondering why you feel that you
3 can ignore that he used the word surprise to say
4 that he confirmed what a person of ordinary skill
5 in the art would have expected?
6 ATTORNEY ARNOLD: Objection. Form.
7 THE WITNESS: Look, like I say, I can't
8 get into his head to understand why he said
9 surprisingly. Look, people publish stuff in the
10 scientific literature all the time that others
11 read and don't necessarily agree with. What's
12 published in the scientific literature, you know,
13 presume to be accurate. We have a peer review
14 process. And so you would like to believe that
15 everything that you read in the peer-reviewed
16 journal article is correct. But unfortunately
17 they're not always correct. I don't take
18 everything that is written in the peer-reviewed
19 article as gospel. So the word surprisingly here
20 is surprising to me. I don't -- I don't have an
21 explanation for what is meant by that or why he
22 says that or what one of ordinary skill in the art
23 would understand reading this, why they would
24 think it was surprising.
25

1 BY ATTORNEY WICHMAN:
2 Q Is it possible -- I mean, is it possible
3 that Dr. Yuasa thought that the formation of
4 magnesium oxide on amorphous CoFeB was a different
5 circumstance from the formation of magnesium oxide
6 on amorphous silicon nitride?
7 ATTORNEY ARNOLD: Objection. Form.
8 THE WITNESS: Look, of course it is
9 different. It is a different material. So I
10 think the charitable way to understand this
11 paragraph and this paper -- it's not -- well, I
12 guess we could say the whole paragraph. The
13 charitable way to understand this is it was
14 already understood -- and I don't think we have
15 any dispute that MgO 001 could be formed on
16 amorphous silicon nitride. It was also
17 understood -- and I have to assume that Dr. Yuasa
18 was aware of the other prior art -- that MgO could
19 be grown on other amorphous substrates, like
20 glass. Now, I don't doubt that he thought, hmm,
21 if I could grow MgO on CoFeB, that would be pretty
22 good. And, you know, when he tried it, it worked.
23 And, you know, hooray, eureka. Just because you
24 anticipated and expected something to work doesn't
25 mean that you don't celebrate when you actually do

it. But it doesn't mean that it's, you know, in the -- in the context of patents, it doesn't mean it is novel or patentable just because you were surprised.

ATTORNEY WICHMAN: Let's take a five-minute break. You can put that exhibit down. So actually, it's 4:51 now.

THE WITNESS: Yeah.

ATTORNEY WICHMAN: Why don't we come back at the top of the hour.

THE WITNESS: Sounds good.

ATTORNEY WICHMAN: That will be 2:00 your time. Off the record.

(A recess was taken.)

ATTORNEY WICHMAN: Okay. Back on the record. Set timers here.

Q All right. Dr. Bokor, let's talk about grain formation on amorphous surface. Okay?

A Okay.

Q Do you agree that the process of magnesium oxide nucleation in grain growth on a surface depends crucially on multiple factors?

ATTORNEY ARNOLD: Objection. Form.

THE WITNESS: That's a fair statement. I'll agree with that.

1 BY ATTORNEY WICHMAN:
2 Q Okay. Do you agree that among those
3 factors, those factors include the materials of
4 the substrate?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: I have not undertaken a
7 detailed analysis of the mechanism involved and
8 all the different parameters. I am happy to --
9 you know, I have given opinions based on prior art
10 findings. I have not formed independent opinions
11 on the mechanisms. So I don't think I can
12 without, you know, undertaking a rather extensive
13 independent study answer questions about the
14 precise mechanisms for the formation of the highly
15 oriented MgO on any particular surface. I just go
16 by the -- the results that I have reported in my
17 declaration.
18 BY ATTORNEY WICHMAN:
19 Q And you have not reported any results
20 about MgO formation on amorphous CoFeB other than
21 your discussion of Parkin; is that right?
22 A Other than what I've already talked about
23 with you this morning, where there were references
24 that said that MgO could grow on any amorphous
25 surface.

1 Q So, Dr. Bokor, can you open in the 1493
2 case, Exhibit 2053.
3 A Okay. I have it.
4 Q Go to paragraph 164, please. It's on PDF
5 page 65.
6 A Paragraph 164.
7 Q Yes.
8 A I'm there.
9 Q Did you review this testimony from
10 Dr. Ross when you formulated your opinions in your
11 reply declaration?
12 A I did.
13 Q In the second sentence here, she says,
14 "The process of magnesium oxide nucleation in
15 grain growth depended crucially on multiple
16 factors." We just discussed that and you agreed
17 with that; correct?
18 A That's a fairly general statement I have
19 to agree with.
20 Q She testified that those factors include
21 the materials. Do you agree with that?
22 Let me rephrase it.
23 Do you agree that the process of
24 magnesium oxide nucleation in grain growth depends
25 crucially on the material of the substrate?

1 A Sure. It can -- it can depend on the
2 material. Yes.
3 Q Do you agree that the process of
4 magnesium oxide nucleation in grain growth depends
5 crucially on the surface morphology of the
6 substrate?
7 A Potentially.
8 Q Do you agree that the process of
9 magnesium oxide nucleation in grain growth depends
10 crucially on the deposition technique used to
11 deposit magnesium oxide?
12 A It depends. You know, depends is a
13 general term. So yes, it depends. It doesn't
14 mean that any -- that only one deposition
15 technique would work. There's a very narrow
16 range. It could be a broad range. It could be a
17 narrow range. We have seen in the literature that
18 I have reviewed and cited in my declaration growth
19 of highly oriented MgO on different materials with
20 different deposition techniques. So it depends.
21 Some deposition -- it could be multiple deposition
22 techniques or materials or surface morphologies
23 all promote that process. The general statement
24 does it depend? Okay, that's a pretty broad
25 general statement or general condition. Depend --

1 depends means depends. You know, it depends.
2 Okay. So it -- yeah, it can depend. It can
3 depend on all of these parameters in her statement
4 there, in principle. How much it depends depends.
5 Q You agree that the process of magnesium
6 oxide nucleation and grain growth depends
7 crucially on the deposition temperature?
8 A It -- it can -- it can depend on
9 deposition temperature. Maybe the -- maybe my
10 quibble is with the word crucially. How crucially
11 the growth depends on all of these different
12 factors can vary. And crucially is a little -- a
13 little -- a little narrow for my understanding.
14 Yes, it depends on temperature.
15 Q Temperature of the substrate.
16 A Yes.
17 Q You agree with that?
18 A Yes. It depends on temperature of the
19 substrate.
20 Q Temperature at which deposition is
21 performed in the chamber. Do you agree on that?
22 A Yes. It can depend on that.
23 Q You agree that the process of magnesium
24 oxide nucleation and grain growth depends
25 crucially on the deposition rate?

1 A I would -- like -- I think -- I think I
2 would focus in my quibble with this sentence on
3 the word crucially. Yes, it depends. That
4 doesn't mean that there isn't a broad range of
5 deposition rate that would give similar result or
6 a broad range of any of these parameters. So
7 that's -- that's really the way I want to answer
8 all of these questions. Depends is rather broad.
9 Crucially is a little too -- a little too
10 restrictive in terms of my -- my understanding --
11 my limited understanding of this.
12 Q Do you agree that in deposition, atoms
13 will arrive on the surface of the substrate? Do
14 you disagree with that?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: I disagree slightly in the
17 sense that sometimes it's molecules that arrive on
18 the surface. Not always will the atoms arrive as
19 atoms. They can arrive as molecules. They can
20 even arrive as clusters of many, many atoms.
21 BY ATTORNEY WICHMAN:
22 Q Do you agree that when atoms arrive on
23 the surface of a substrate, they move by -- on the
24 surface by diffusion?
25 A They can.

1 Q Do you agree that when atoms arrive on
2 the surface, they eventually form a nucleus or are
3 incorporated into a growing grain?
4 A They can. That's one possibility. In my
5 understanding of materials deposition, there are
6 many different ways -- there are many different
7 kinds of dynamics. This is one of them.
8 Q Do you agree that the process of
9 magnesium oxide nucleation and grain growth
10 depends on the surface energy of the substrate?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: Is that -- is that
13 something that she mentions in here? I'm looking
14 for it. Or are you asking that in the abstract?
15 BY ATTORNEY WICHMAN:
16 Q I'm asking you as an expert on grain --
17 on thin film formation, Dr. Bokor.
18 A Can it depend on surface energy? It can.
19 Q Does the formation of -- or does the
20 process of magnesium oxide nucleation and grain
21 growth depend on the bonding of the material that
22 is the substrate?
23 ATTORNEY ARNOLD: Objection. Form.
24 THE WITNESS: The bonding availability?
25 Is that what you said?

1 BY ATTORNEY WICHMAN:
2 Q Yes.
3 A I'm not familiar with that term. I don't
4 know what it means.
5 Q Do you agree that the formation of
6 magnesium oxide nucleation in grain growth depends
7 on the interface surface energy?
8 A I'm not familiar with that term.
9 Q Can you open Exhibit 2048.
10 A I have it.
11 Q Do you agree this is an undergraduate
12 textbook for Materials Science of Thin Films?
13 A Well, I'm not a faculty member in
14 materials science. So I'm a little reluctant to
15 testify as to whether or not it is an
16 undergraduate-level textbook. But it sure doesn't
17 look like it to me. It looks like a
18 graduate-level textbook, I would say. I have
19 never taught undergraduate courses in the
20 materials science department. So I would -- I
21 would hesitate to, you know, definitively answer
22 that question.
23 Q Could you go to PDF page 16. This should
24 be internal page 201. Do you see there's a
25 section 5.2.2, nucleation rate?

1 A I see that.
2 Q Okay. If you go down one, two -- third
3 sentence starts with "rather." It says, "Rather
4 the rate at which critical nuclei grow depends on
5 the rate at which adsorb monomers adatoms attached
6 to it." Do you see that?
7 A I see that.
8 Q An adsorbed monomer or an adatom is an
9 atom that has -- let's say, sticks to the
10 substrate; is that right?
11 A That's fair.
12 Q Okay. If you drop down under the
13 equation, there's a sentence, "Adatoms which had
14 not yet thermally accommodated to the substrate
15 execute random diffusive jumps and, in the course
16 of their migration, may form pairs with other
17 adatoms or attach to larger atomic clusters and
18 nuclei." Right?
19 A You read that correctly.
20 Q Okay. Do you agree with that statement?
21 ATTORNEY ARNOLD: Objection. Form.
22 THE WITNESS: Well, this -- this
23 document, although it is in the record, I have --
24 and it looks vaguely familiar. I think I have
25 looked at it. I certainly have not reviewed it in

1 preparation for this deposition or in preparation
2 of my reply or my second declaration. So I
3 don't -- I don't -- I don't feel comfortable
4 offering opinions on interpretation of any of the
5 text in this -- in this document. I would have to
6 review it independently and separately to be able
7 to answer questions about the content in this
8 thing, in most cases. I mean, some of the
9 statements in here are, you know, elementary. So
10 certain statements that -- like the one you
11 referred me to a moment ago, you know, the adatoms
12 stick to the surface and diffuse around, okay,
13 that I'm comfortable with. But I'm not willing
14 to, you know, entertain any question that you can
15 come up with on how do I interpret some of the
16 statements in this document.
17 BY ATTORNEY WICHMAN:
18 Q Well, I'm asking you to rely on your
19 expertise in materials science of thin films.
20 Okay?
21 A Well, okay. That's what I'm saying.
22 Relying on that expertise, I can answer some
23 questions. But I have not -- this is a -- I
24 consider this to be an advanced text. Okay. It
25 looks to me like a graduate-level text of

1 materials science, not undergraduate. And so
2 there's going to be a lot of material in this book
3 that I'm not going to be able to just interpret,
4 explain to you, based on my level of expertise
5 without additional time to review and study and
6 bone up on what this -- what's in there.
7 Q Okay. I'm going to ask questions. And
8 if that -- if you feel you are not equipped to
9 answer the question, why don't you just tell me
10 that. Can we agree on that?
11 A Yes.
12 Q All right. Do you see this reference to
13 ES-des, described as the energy required to desorb
14 an atom back into vapor? Do you see that?
15 A I do.
16 Q Do you understand that that means the
17 energy of an ad- -- that an adatom would require
18 to return to a vapor state?
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: Yeah. That part -- that
21 much I feel comfortable with.
22 BY ATTORNEY WICHMAN:
23 Q Okay. So now drop down. Do you see this
24 sentence, "Changes in ES-des are particularly
25 expected at substrate heterogeneities such as

1 cleavage steps or ledges where the binding energy
2 of adatoms is greater relative to a planer
3 surface." Do you see that?
4 A I see that.
5 Q It says, "The proportionally large number
6 of atomic bonds available at these accommodating
7 sides leads to higher ES-des values." Right?
8 A Right.
9 Q That means more atoms are going to stick
10 there that had heterogeneity on the surface;
11 right?
12 ATTORNEY ARNOLD: Objection. Form.
13 THE WITNESS: Well, I see what it says
14 here. In my understanding, to the best of my
15 understanding, this is not true in all cases. So
16 there can be -- my understanding, there can be
17 substate heterogeneities which have lower binding
18 energy for adatoms. I can't name which ones are
19 which and what the circumstances are and for what
20 atoms that applies to. But my general
21 understanding and expectation would be that while
22 this sentence might be largely true, I strongly
23 expect that there are exceptions.
24 BY ATTORNEY WICHMAN:
25 Q So the next sentence says, "For this

1 reason" -- the reason being that the
2 proportionally large number of atomic bonds
3 available at these accommodating sites, meaning
4 the substrate heterogeneities -- "leads to a
5 higher ES-des value. For this reason, a
6 significantly higher density of nuclei is usually
7 observed near cleavage steps and other substrate
8 imperfections." Right?
9 A You read it correctly.
10 Q So that means that more stuff is going to
11 stick at an imperfection on a substrate; right?
12 A Let me emphasize the word usually. So
13 that's consistent with what I just said. I agree
14 with usually. But I don't think -- I think there
15 can be exceptions.
16 Q The next sentence, "The presence of
17 impurities similarly alters ES-des" -- let's call
18 that the desorption energy -- "in a complex manner
19 depending on type and distribution of atoms or
20 molecules involved."
21 All right. First, I read that correctly;
22 right?
23 A Yes.
24 Q And do you agree with that statement?
25 ATTORNEY ARNOLD: Objection. Form.

1 THE WITNESS: That seems to be a
2 pretty -- pretty general statement that I would
3 agree with.
4 BY ATTORNEY WICHMAN:
5 Q Okay. You agree that thin film synthesis
6 generally takes place far from thermodynamic
7 equilibrium?
8 A Well, that is a pretty vague statement in
9 and of itself. Generally and far from are vague.
10 So what does far from thermal equilibrium mean?
11 It means different things in different contexts.
12 It depends. It is a general statement that I can
13 agree with, but it has -- it is very broad.
14 Q Okay. Do you agree that microstructure
15 during deposition typically evolves in a
16 competitive fashion?
17 ATTORNEY ARNOLD: Objection. Form.
18 THE WITNESS: Is that a sentence that
19 you're reading from this?
20 BY ATTORNEY WICHMAN:
21 Q Do you agree with the statement,
22 Dr. Bokor?
23 A I'm not sure that I understand the
24 statement.
25 Q All right. Can you -- can you open

1 Exhibit 2060. This is Petroff.
2 A Okay. I have it.
3 Q All right. And the first page is S117,
4 it's PDF page 1, the left-hand column under
5 introduction. Let me know when you're there.
6 A I'm there.
7 Q Okay. And the second paragraph, if you
8 drop down, there's a sentence that says, "Thus,
9 film synthesis generally takes place far from
10 thermodynamic equilibrium." Right?
11 A Wait. Wait. Hold on. Where is this?
12 Left-hand column?
13 Q Left-hand column, second paragraph under
14 the introduction header.
15 A Yeah.
16 Q Drop down a couple sentences. There's a
17 sentence that starts, "Thus, film synthesis."
18 A There. I found it. Okay.
19 Q Okay. It reads, "Film synthesis
20 generally takes place far from thermodynamic
21 equillibrum." And you say that that is too
22 general for you to agree or disagree; is that
23 right?
24 A It is a very general statement. It is
25 hard to disagree with it. Like I say, it -- you

1 know, it's got some vague terminology, generally
2 and far from. So it's hard to disagree with that
3 because it depends on what you mean by it. It
4 depends. We were talking before about depends;
5 right? The sentence -- the understanding of this
6 sentence depends. It depends on how far, what
7 does far mean, what does generally mean. It is a
8 rather vague statement. Hard to -- hard to, you
9 know, work with.
10 Q Do you see the next sentence that says,
11 "As a consequence, microstructure during
12 deposition typically evolves in a competitive
13 fashion"? Do you see that?
14 A You read it correctly.
15 Q Do you agree with that statement?
16 ATTORNEY ARNOLD: Objection. Form.
17 THE WITNESS: This now we're getting into
18 territory that I spoke about earlier. This is a
19 similar -- I certainly read this paper. But it
20 was a while ago. I came away from reading this
21 paper with some rather general -- general
22 conclusions and takeaways. I didn't -- I didn't
23 read every single sentence, every single section
24 deeply enough to decide whether I agree with it
25 and understand it. So now asking me to answer

1 questions about that sentence, I would need more
2 time to review to give you a -- a -- a reliable
3 answer.
4 BY ATTORNEY WICHMAN:
5 Q You testified that during deposition,
6 there are atoms that arrive at the substrate;
7 right?
8 A That's a fair statement.
9 Q And you testified that during deposition,
10 there could be molecules that arrive at the
11 substrate; right?
12 A Right.
13 Q And you said there was something else,
14 material clusters --
15 A Clusters.
16 Q -- that can arrive at the substrate;
17 right?
18 A Yes.
19 Q Okay. Let's talk about magnesium oxide.
20 So a deposition of magnesium oxide can involve
21 magnesium oxide atoms; right?
22 A Right.
23 Q Oxygen atoms?
24 A Right.
25 Q It can involve clusters of magnesium

1 oxide; is that right?
2 A It could. I'm not so sure how important
3 that -- that is in the deposition of magnesium
4 oxide, clusters of magnesium oxide. In general,
5 it is fair to say that it could. But I don't know
6 how important that is. Certainly atoms, magnesium
7 and oxygen undoubtedly play an important role.
8 Q So we can think about it in terms of
9 depositing or atoms of magnesium and atoms of
10 oxygen arriving at the substrate; is that right?
11 A We can think about it in those terms. I
12 think the -- before we get to clusters, I think
13 magnesium oxide molecules are very likely to also
14 play a role. I think I did see reference to that
15 in some of the literature.
16 Q Dr. Bokor, magnesium oxide is an ionic
17 compound; correct?
18 A Correct.
19 Q So it is an ionic solid, not a molecule;
20 right?
21 A No, that is not correct. There is no
22 problem forming a diatomic molecule with an ionic
23 bond. And magnesium oxide molecules are
24 certainly -- you know, magnesium oxide molecules
25 should be, to the best of my understanding, stable

1 in vacuum. You can have an MgO molecule that will
2 stick together. You can have MG atoms. You can
3 have O atoms. You can have MgO molecules. You
4 can have clusters for sure. What I don't know is
5 how much of a role the clusters might play in the
6 MgO depositions that we've been looking at in the
7 papers and that are involved in this case. But
8 there's discussion in some of the literature
9 involved in the case having to do with, you know,
10 whether you get oxygen defects or not when you
11 deposit MgO. Having to do whether you have extra
12 oxygen in the chamber. Whether some of the MgO
13 molecules disassociate so that the MG and the O
14 atoms can come to the surface at different rates.
15 That could lead to imperfect stoichiometry.
16 That's -- that's been part of the literature that
17 I have reviewed with respect to this case. And
18 MgO molecules bring down stoichiometric MgO. So
19 that -- that's important.
20 Q What type of bond does oxygen form with
21 iron?
22 ATTORNEY ARNOLD: Objection. Form.
23 THE WITNESS: I'm going to be -- I'm
24 going to duck on answering that question. I think
25 I know, but I'm not positive. So I don't want to

1 answer that question without having to refer back
2 to literature.
3 BY ATTORNEY WICHMAN:
4 Q So you would agree that if we were to
5 articulate a taxonomy of chemical bonds there are
6 covalent bonds?
7 A Right.
8 Q And in covalent bond, electrons are
9 shared between atoms; is that right?
10 A That's a -- that's a reasonable
11 characterization.
12 Q There is an ionic bond; correct?
13 A Correct.
14 Q And ionic bonds electrons are actually
15 transferred from one atom to another; is that
16 right?
17 A That's part of the ionic bonding process.
18 Q Is an ionic bond stronger than a covalent
19 bond?
20 A I certainly can't answer that question in
21 the general case. And I don't have in my mind
22 what the numbers for the bonding energies are for
23 particular molecules, so I couldn't answer about
24 specific examples either. So I'm uncomfortable
25 answering that question without studying it.

1 Q Is there a metallic bond a form of
2 chemical bond?
3 A I'm not familiar with that term.
4 Q Where electrons are shared among large
5 groups of metal atoms?
6 A I'm not familiar with that.
7 Q Okay. What other type of chemical bond
8 would you identify?
9 A I think we have covered them. The
10 chemical bonds I'm aware of are covalent bonds --
11 no, there's another one. Covalent bonds, ionic
12 bonds, and then there's another type of bond
13 called Van der Waals. There are Van der Waals
14 bonds.
15 Q They're related to proximity and distance
16 of the atoms to the surface?
17 A They are related to that. The physics of
18 a Van der Waals bond -- you know, we talked about
19 the physics of the covalent bond and the physics
20 of the ionic bond. The physics of the Van der
21 Waals bond is different than either of those two.
22 It is generally weaker. That much I can state
23 from my own knowledge. And at least what I have
24 in my -- you know, I haven't gone through and done
25 a, you know, extensive review of all of chemical

1 bonding. But as I sit here right now, those are
2 the three chemical bonds I'm aware of. The three
3 kinds of bonds that I'm aware of.
4 Q Okay. And I asked you what type of bond
5 is actually formed with iron. But you're not
6 willing to say?
7 A I would rather not say. I -- I would
8 rather not guess because I don't have that in the
9 right of -- fresh in the front of my mind. I
10 would have to -- I could -- I could find out
11 pretty quickly, but I don't -- I don't know that
12 right now -- right as I sit here.
13 Q But you agree that oxygen will bond with
14 iron and form iron oxide?
15 A Yeah. That -- that sounds right.
16 Q And what kind of bond will oxygen form
17 with cobalt iron?
18 A Cobalt iron?
19 Q Yeah.
20 A Well, again, that I don't know off the
21 top of my head. Cobalt iron and oxygen, now we're
22 talking about a triatomic system. You're talking
23 about oxygen bonding to a cobalt iron diatomic
24 molecule? Is that what you're asking? You're
25 asking about --

1 Q What type of bond will oxygen -- would
2 you -- would a POSA have expected oxygen to form
3 with a cobalt iron substrate?
4 ATTORNEY ARNOLD: Objection. Form.
5 THE WITNESS: Yeah. I'm -- I don't think
6 I want to answer that question without having an
7 opportunity to review the literature.
8 BY ATTORNEY WICHMAN:
9 Q And what kind of bond would oxygen form
10 with a cobalt iron boron substrate?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: Same -- same answer.
13 BY ATTORNEY WICHMAN:
14 Q Is the bond that oxygen would form with
15 an iron substrate stronger than the bond that
16 oxygen would form with magnesium?
17 ATTORNEY ARNOLD: Objection. Form.
18 THE WITNESS: Yeah. I can't answer that
19 question just sitting here.
20 BY ATTORNEY WICHMAN:
21 Q Is the bond that oxygen would form with a
22 cobalt iron substrate stronger than the bond that
23 oxygen would form with magnesium?
24 ATTORNEY ARNOLD: Objection. Form.
25 THE WITNESS: Same answer.

1 BY ATTORNEY WICHMAN:
2 Q Is the bond that oxygen would form with a
3 cobalt iron boron substrate stronger than the bond
4 an oxygen atom would form with magnesium?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: Same answer.
7 BY ATTORNEY WICHMAN:
8 Q What type of bond would magnesium form on
9 an iron substrate?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: I don't know.
12 BY ATTORNEY WICHMAN:
13 Q But you agree that if you're depositing
14 magnesium oxide, a magnesium oxide -- atom has to
15 form some sort of bond with the substrate if it is
16 going to stick there; right?
17 A That's fair.
18 Q But you don't know what kind of bond that
19 would be with magnesium oxide substrate?
20 A Not of the top of my head.
21 ATTORNEY ARNOLD: Objection.
22 THE WITNESS: Not without further review.
23 I'm not prepared to answer questions like that.
24 BY ATTORNEY WICHMAN:
25 Q And you don't know what type of bond

1 magnesium would form with cobalt iron substrate on
2 deposition; right?
3 ATTORNEY ARNOLD: Objection.
4 THE WITNESS: Correct.
5 BY ATTORNEY WICHMAN:
6 Q And you don't know what type of bond a
7 magnesium atom would form with a cobalt iron boron
8 substrate in deposition, do you?
9 A Not sitting here right now.
10 Q Okay. And is the bond that a magnesium
11 atom would form with an iron substrate stronger
12 than the bond that the magnesium atom would form
13 with an oxygen atom?
14 ATTORNEY ARNOLD: Objection. Form.
15 THE WITNESS: I can't answer that
16 question. I don't know. Sitting here right now,
17 you know, I'm -- I'm here to answer questions
18 about my second declaration. Nothing in my second
19 declaration went anywhere near this level of, you
20 know, microscopic detail about surface bonding.
21 So I'm not prepared -- I'm not prepared to answer
22 questions about surface bonding. I came to
23 conclusions that I put in my declaration.
24 BY ATTORNEY WICHMAN:
25 Q So when you -- when you formed the

1 opinion that a person of ordinary skill in the art
2 would regard the formation of magnesium oxide thin
3 films on silicon dioxide or silicon nitride or
4 glass or soda glass and that that was
5 representative of what would happen to magnesium
6 oxide on cobalt iron boron, you did not consider
7 the differences in the atomic bonding between
8 cobalt iron boron and a magnesium or oxygen atom
9 and the bonding that would take place between
10 magnesium and/or oxygen in any of those other
11 substrates, did you?
12 ATTORNEY ARNOLD: Objection. Form.
13 THE WITNESS: I did not undertake a
14 fundamental analysis of the physics of this
15 bonding. Instead, I relied on statements in the
16 literature by experts who were presumably familiar
17 with all of those details that stated that the
18 magnesium oxide growth would proceed on any
19 amorphous substrate.
20 BY ATTORNEY WICHMAN:
21 Q Not just the growth, but that it would
22 grow in a 100 texture?
23 A Correct. That's -- I found -- I found
24 statements in the literature from material
25 scientists that said that. And I -- I relied on

1 that.
2 Q So --
3 A The expertise of those material
4 scientists who published statements like that.
5 Q Do you agree that if magnesium oxide
6 forms a stronger bond on a cobalt iron boron
7 substrate than it would form on a silicon dioxide
8 substrate, then that magnesium oxide will have a
9 lower diffusivity on the cobalt iron boron
10 substrate?
11 ATTORNEY ARNOLD: Objection. Form.
12 THE WITNESS: I'm not prepared to answer
13 that question sitting here today.
14 BY ATTORNEY WICHMAN:
15 Q But you agreed with the proposition that
16 grain formation and magnesium oxide film in
17 nucleation depends on factors such as the material
18 of the substrate and the diffusivity of the atom
19 that arrives on the substrate; right?
20 A I think what I testified is I agree that
21 the deposition of a thin film can depend on those
22 factors.
23 Q And --
24 A How strongly they depend on those factors
25 varies a lot from system to system. It depends on

1 other parameters, like temperature, gas pressure.
2 It is a very complicated -- I certainly agree it
3 is a very complicated business. And I'm not
4 prepared -- I feel completely qualified to study
5 up and testify about this topic. But I'm not
6 prepared today to do that. I did not --
7 Q So you didn't consider the -- the bonding
8 energy -- the differences in bonding energy
9 between cobalt iron boron and any of these other
10 amorphous substrates with atomic magnesium or
11 atomic oxygen that would arrive in a deposition on
12 that substrate?
13 ATTORNEY ARNOLD: Objection. Form.
14 THE WITNESS: Let me answer the question
15 this way: First of all, I did not undertake an
16 independent analysis at the atomic level such as
17 what you're describing, regarding MgO deposition
18 on the variety of surfaces we've been
19 discussing -- glass, silicon dioxide, soda glass,
20 silicon nitride, cobalt iron boron. I did not
21 undertake own independent analysis of the physics
22 of this deposition. I rely -- as I said, I relied
23 on statements in the literature from experts
24 who do -- who do presumably have a detailed
25 understanding of all of those factors. That's

1 what I relied on in giving my opinion regarding
2 that the growth of oriented 100 MgO on cobalt iron
3 boron was known to a person of ordinary skill in
4 the art.
5 BY ATTORNEY WICHMAN:
6 Q I'm sorry. I just don't understand your
7 testimony. Let me ask again. Are you saying that
8 you cite evidence that a person of ordinary skill
9 in the art knew specifically that magnesium oxide
10 deposited on cobalt iron boron in particular would
11 form with a 100 texture because there are some
12 examples of magnesium oxide forming with a 100
13 texture on different materials? Is that your
14 testimony?
15 A That and the further statement in at
16 least one of the references I cited that it would
17 grow on any amorphous surface. It would grow in
18 that structure in any amorphous surface.
19 Q Okay. So --
20 A I'm sure -- I'm sure we saw this morning
21 a statement of that in one of the references.
22 Q Point me to a document that specifically
23 says magnesium oxide will form in a 100 texture
24 when deposited on cobalt iron boron.
25 A We covered this this morning before

1 lunch.
2 Q Humor me.
3 A I did not cite a -- such a reference.
4 What I said -- what I cited were references that
5 said that results obtained by -- in that
6 particular study indicated that it would grow on
7 any amorphous surface. And cobalt iron boron
8 falls within the category of any amorphous
9 surface.
10 Q So I'm asking you to identify a specific
11 teaching about magnesium oxide and cobalt iron
12 boron. And your answer is all you can point to
13 are generalizations that these other materials are
14 somehow representative of cobalt iron boron; is
15 that correct?
16 A Well, that's -- that's part of the story.
17 Let me -- let me add -- let me add just one thing,
18 since you just took me through, for example,
19 Exhibit 2060, which was cited by Dr. Ross, I
20 didn't find anything in this Petroff article that
21 has anything to do with -- well, that specifically
22 mentions cobalt iron boron or magnesium oxide.
23 And I -- when I read this article, I did not find
24 anything that I could use to definitively help me
25 figure out what would happen if you deposit MgO on

1 cobalt iron boron in light of the result that it
2 can be grown on other amorphous surfaces. So
3 these other articles that Dr. Ross cited didn't --
4 didn't shed any light on the question from my
5 point of view.
6 Q Can you open Exhibit 2062.
7 A Sure. Okay.
8 Q You read this article?
9 A Yes.
10 Q You're familiar with this article?
11 A This one I am familiar with.
12 Q Okay. Can you go to PDF page 5, which is
13 page 625 of the document.
14 A Okay.
15 Q The bottom of the first paragraph, at
16 the -- at the -- on the left-hand column of 625
17 ends with the sentence, "The interfacial
18 interaction between the deposit irons or molecules
19 and substrate atoms can be assumed to be quite
20 strong," in the example that they were discussing.
21 Right?
22 A I see that.
23 Q Okay. As a result of the high-binding
24 energy of the deposit ions to the substrate
25 surface in this case, the surface mobility is

1 decreased. Do you see that?
2 A I do.
3 Q What does it mean that surface mobility
4 is decreased?
5 A Surface mobility refers to the fact that
6 atoms or ions on the surface of a solid at finite
7 temperatures can move around on the -- they stay
8 on the surface, but they move around, diffuse.
9 They randomly move around.
10 Q And that's what happens when atoms arrive
11 during a deposition of film, like depositing
12 atomic magnesium and atomic oxygen on a substrate;
13 right?
14 A In general, there can be surface
15 diffusion. Here, they're talking about factors
16 that can decrease the surface diffusion. The
17 surface diffusion can increase or decrease
18 depending on a variety of factors. Or not. It
19 may be very independent of a number of factors.
20 That's why the "crucially" was a sticking point
21 for me in Dr. Ross' declaration. It is not always
22 crucial how -- how film deposition depends on any
23 of those factors. Such as surface diffusion.
24 Q In Exhibit 2062, in this paragraph, on
25 page 625, the second paragraph, the first full

1 paragraph, he goes on to say, "In this case, the
2 surface mobility is decreased," comma, "the
3 nucleation rates are high, and owing to the more
4 or less random, substrate atoms, no preferred
5 orientation is induced." Is that right?
6 A I'm sorry. I got lost. Could you point
7 me again where this is?
8 Q Let's read the full sentence. Do you see
9 the paragraph starts with "As a result"?
10 A As a -- I see that.
11 Q Okay. "As a result of the high-binding
12 energy of the deposit ions to the substrate
13 surface in this case, the surface mobility is
14 decreased, the nucleation rates are high, and
15 owing to the more or less random arrangement of
16 the substrate atoms, no preferred orientation is
17 induced." Do you see that?
18 A Yes.
19 Q And the preferred orientation is
20 referring to the grains that are forming for this
21 film on the substrate; right?
22 A Right.
23 Q Okay. So this is stating that when
24 there's high-binding energy that reduces mobility,
25 you would have a more or less random

1 arrangement -- with a more or less random
2 arrangement of substrate atoms that no preferred
3 orientation would be induced in the grains that
4 are forming on that substrate; right?
5 ATTORNEY ARNOLD: Objection. Form.
6 THE WITNESS: That is the interpretation.
7 That is frankly speculation on the part of the
8 authors of this article.
9 BY ATTORNEY WICHMAN:
10 Q Two sentences later, they say, "On the
11 other hand, if the interfacial interaction between
12 the deposit ions and the substrate atoms is weak,
13 the nucleation rates are lower and a 100
14 orientation may then be expected to be preferred
15 since this orientation best minimizes the
16 interfacial and surface free energies." Right?
17 A You read it correctly.
18 Q What is an interfacial free energy?
19 ATTORNEY ARNOLD: Objection. Form.
20 THE WITNESS: I'm not sure I can give you
21 a simple explanation for that without further
22 study.
23 BY ATTORNEY WICHMAN:
24 Q What is surface free energies that is
25 being referred to here?

1 A Yeah. I -- I'm not prepared to give an
2 explanation of surface free energy as we sit here
3 right now.
4 Q All right. Dr. Bokor, let me ask you a
5 hypothetical. If oxygen has a higher binding
6 energy with cobalt iron boron substrates than it
7 does with silicon dioxide, would it be consistent
8 with this explanation that we just read in
9 Exhibit 2062 to expect that the magnesium oxide
10 that forms on the cobalt iron boron would have no
11 preferred orientation; whereas due to the weaker
12 interactions with silicon nitride, magnesium oxide
13 grains could form with a 100 orientation on
14 silicon dioxide?
15 ATTORNEY ARNOLD: Objection. Form.
16 THE WITNESS: I am not prepared to answer
17 a question like that.
18 BY ATTORNEY WICHMAN:
19 Q Why not?
20 A I -- as I testified earlier, I have not
21 undertaken an independent detailed atomic analysis
22 of growth on MgO surfaces. So I can't answer that
23 question.
24 Q I'm just asking you to apply the
25 statements that we just read here in Exhibit 2062

1 to the case where there is a higher bending energy
2 with one substrate than the other?
3 A I am not prepared to answer that
4 question.
5 Q Why not?
6 A I would need -- I would need time to
7 study the -- study this article so that I feel
8 comfortable that I completely understand the
9 statement here and can undertake an analysis to
10 answer your question. I will say that -- I think
11 it is worth noting here that I did cite this
12 reference in my declaration. And then I cited
13 another reference for growing MgO on essentially
14 the same substrate that got a completely different
15 result. And so for that reason especially, before
16 I would take anything that is written in this
17 article on faith, I would need to, you know,
18 incorporate the fact that a very different result
19 was obtained for this -- for MgO grown on the same
20 surface by another investigator. And that would
21 be a factor in my analysis of the details of the
22 mechanism here.
23 Q I want to ask you a few questions about
24 these references that you cited. How are we doing
25 on time here? Do you need a break now or can you

1 go for a little bit more?
2 A Define a little bit. Are we going to
3 go an hour or another five minutes?
4 Q It depends on you. We will take a
5 five-minute break.
6 A Let's do that.
7 ATTORNEY WICHMAN: All right. Off the
8 record.
9 (A recess was taken.)
10 ATTORNEY WICHMAN: All right. On the
11 record.
12 Q Dr. Bokor, can you open Exhibit 1097,
13 please.
14 A I'm just going to -- I need to create a
15 little space on my desktop here.
16 1097? Was that it?
17 Q Yes.
18 A Okay. Got it.
19 Q The article's title begins, "Deposition
20 of in-plane textured magnesium oxide on amorphous
21 silicon nitride substrates by
22 ion-beam-assisted deposition." Correct?
23 A Correct.
24 Q So this article describes in-plane
25 alignment of a magnesium oxide film being affected

1 by the orientation of an ion-beam-assisted
2 deposition ion beam; is that right?
3 A Let's -- that's reasonably fair
4 description.
5 Q Okay. The in-plane alignment of texture
6 in a ferromagnetic underlayer does not affect TMR
7 for a magnesium oxide MTJ, does it?
8 A Not as far as I'm aware. I can't say it
9 doesn't. I don't think I've seen any evidence for
10 that.
11 Q The 100 orientation that we've been
12 talking about for the magnesium oxide texture is
13 actually perpendicular to this deck; right?
14 A Right.
15 Q Okay. So in-plane alignment is parallel
16 to the ferromagnetic underlayer; right?
17 A Right.
18 Q So Exhibit 1097 used 700 electron volts
19 argon ion energies; is that right?
20 A I see that, yeah.
21 Q It's on page 2955, the bottom left
22 column. Right?
23 A Right.
24 Q All right. So that's -- it's a beam of
25 argon ions that they're shooting into the

1 material; right?
2 A That's correct.
3 Q And they have a particular flux. They
4 describe it as 110 to 120 micro amps per cubic --
5 per square centimeter; correct?
6 A Correct.
7 Q And so the idea of ion-beam-assisted
8 deposition is that that energetic ion beam is
9 going to guide the formation of grains on the
10 surface; is that right?
11 A Roughly speaking, yes.
12 Q Have you ever made an MTJ using
13 ion-beam-assisted deposition?
14 A Personally, no.
15 Q Do you know anyone who has?
16 A Not off the top of my head.
17 Q All right. You agree that in a magnesium
18 oxide MTJ, the good TMR requires a good interface
19 between the ferromagnetic underlayer and the
20 magnesium oxide barrier layer?
21 A Well, we would have to get into a
22 detailed discussion of what means good.
23 Q Can you open Exhibit -- oh, go ahead.
24 A No. Go ahead.
25 Q Exhibit 1084 in the 1493 case.

1 A I have it.
2 Q Okay. If you go to page 225, which is
3 PDF page 3 at the top right.
4 A Okay. Before we do that, let's just make
5 sure that we're both looking at the same
6 reference. This is 1084 Boubeta.
7 Q Yes. Epitaxial iron/magnesium oxide
8 heterostructures on gallium arsenic.
9 A All right. Where do you want to go?
10 Q Page 225. It is PDF, page 3. In the top
11 right column.
12 A Got it.
13 Q Do you see the sentence that starts
14 "worth to mention"?
15 A How far down is that?
16 Q It's the eighth line from the top.
17 A Let's make -- I'm not finding it. You're
18 looking at the PDF page 2?
19 Q 3.
20 A Oh, that's where it went.
21 Q Page 225.
22 A Sorry. Okay. Worth to mention.
23 Q All right. It says, "Worth to mention is
24 the faceted nature of the iron surface for RT" --
25 that is room temperature -- "deposition in

1 Figure 1C." Right?
2 A I see that.
3 Q The next sentence says, "This faceted
4 morphology can be detrimental for the fabrication
5 of magnetic tunnel junctions where very flat
6 surfaces are required." Right?
7 A You read it correctly.
8 Q And you agree that in a magnetic tunnel
9 junction with a magnesium oxide barrier, you want
10 a very flat surface for the ferromagnetic layers;
11 correct?
12 A Correct.
13 Q And you tell me if you recall that Bowen,
14 Exhibit 1026, says essentially the same thing?
15 A I don't specifically recall that Bowen
16 says the same thing. But it is a fairly general
17 statement that I wouldn't be surprised to find in
18 Bowen.
19 Q Okay. So you agree that you want that
20 interface between the ferromagnetic layer and the
21 magnesium oxide tunnel barrier needs to be very
22 flat; correct?
23 A That's fair.
24 Q Okay. Now, if the idea of
25 ion-beam-assisted deposition is to guide the

1 orientation of the grain growth, then if you
2 wanted to use it to guide grain growth with a
3 100 orientation, you would have to aim that ion
4 beam directly at the substrate; right?
5 A Not necessarily. I don't agree with
6 that.
7 Q No? Okay. What would happen if you
8 directed a 700 electron volt argon ion beam at the
9 surface of a cobalt iron boron underlayer?
10 ATTORNEY ARNOLD: Objection. Form.
11 THE WITNESS: I don't think I can answer
12 that. I can't answer that question.
13 BY ATTORNEY WICHMAN:
14 Q Would you expect that you would damage
15 the surface?
16 ATTORNEY ARNOLD: Objection. Form.
17 THE WITNESS: I don't -- I don't have an
18 expectation. I don't know the answer to that. I
19 haven't done the experiment. I don't recall
20 seeing any literature on that. So I can't -- I
21 can't answer that question definitively.
22 BY ATTORNEY WICHMAN:
23 Q Okay. If you want to maintain a very
24 flat and uniform substrate surface, under what
25 circumstances would you ever direct an energetic

1 ion beam at that surface?
2 ATTORNEY ARNOLD: Objection. Form.
3 THE WITNESS: As I sit here right now, I
4 don't have an answer to that question.
5 BY ATTORNEY WICHMAN:
6 Q Okay.
7 A I would have to -- I would have to
8 undertake some separate study of that.
9 Q You can open Exhibit 1098, please.
10 A 98. Okay.
11 Q Do you have?
12 A I have it.
13 Q This is the Inaba reference.
14 A Yes.
15 Q Okay. So Inaba on the -- under the --
16 there's an experimental procedure section on the
17 bottom left of 2372, which is PDF 1.
18 A I see that.
19 Q It says that we use a custom-made
20 sputtering system; right?
21 A Right.
22 Q And there's a cartoon of it in Figure 1
23 on the top right of -- top right column on page
24 2372; right?
25 A Yes.

1 Q And this was to provide -- what they're
2 doing is ECR sputtering; right?
3 A Correct.
4 Q Electron cyclotron resonance sputtering?
5 A That's right.
6 Q And that's different from RF sputtering;
7 right?
8 A It is.
9 Q Have you ever made a magnetic tunnel
10 junction using electron cyclotron resonance
11 sputtering?
12 A Okay. So let me remind you of -- I'm
13 sure you remember. But let me put on the record
14 what I said in my first deposition regarding what
15 I have personally done. So I have not in my
16 career personally with my own two hands fabricated
17 magnetic tunnel junctions of any kind. What I
18 have done is participated as a collaborator in a
19 group where magnetic devices, such as MTJs, were
20 fabricated by other members of the group. I'm
21 generally familiar with what was done, but
22 typically not in the -- all the details. I just
23 knew generally what was being done to make the
24 samples that we were studying in my research.
25 Q You --

1 A So --
2 Q Go ahead.
3 A -- to answer your question, I have not
4 made MTJ devices using ECR sputtering. And as I
5 sit here right now, I didn't anticipate this
6 question, so I haven't gone back to double-check
7 what deposition process was used in the
8 experiments that my group did. So I can't answer
9 at that question.
10 Q Are you aware of any example of anyone
11 making an MTJ using ECR sputtering?
12 A I can't cite one right now, but I don't
13 know that that has not ever been done.
14 Q So that means that you're not aware of
15 any example?
16 A Well, not as I sit here right now. I'm
17 aware of quite a bit of literature reporting
18 fabrication of MgO tunnel junctions. And whether
19 or not any of them ever used ECR sputtering, as I
20 sit here right now, I don't recall. That doesn't
21 mean that there aren't any.
22 Q If you turn --
23 A It's completely unreasonable to me to use
24 ECR sputtering. It's not like I can think of a
25 reason, no, nobody would ever do that.

1 Q Is ECR sputtering a standard technique
2 for fabricating MTJs?
3 A I don't know.
4 Q If you turn to page 2373. This should be
5 PDF page 2, the bottom left.
6 A I'm there.
7 Q All right. A few sentences up from the
8 bottom of the first -- of that large paragraph, it
9 says, "These results mean that the 10 millimeter
10 thick MgO seed layer shows well-developed 100
11 texture." Right?
12 A Right.
13 Q All right. So in Inaba Exhibit 1098,
14 this MgO seed layer was an underlayer for
15 depositing additional materials; right?
16 A Correct.
17 Q It was not a barrier layer, was it?
18 A It's not a tunnel barrier layer, that's
19 for sure.
20 Q Can you open Exhibit 1099.
21 A Okay.
22 Q So this is the paper that you referred to
23 as Tonouchi, the first author.
24 A Right.
25 Q The paper is epitaxial growth of niobium

1 nitride on an ultrathin magnesium oxide
2 semiconductor system; right?
3 A Right.
4 Q All right. At page 964, which is PDF 5,
5 just let me know when you're there.
6 A Okay.
7 Q All right. On the left-hand column,
8 second full paragraph, towards the bottom,
9 Tonouchi describes an NbN epitaxial layer was then
10 obtained on a 10-angstrom magnesium oxide silicon
11 dioxide structure; right?
12 A Hang on. I'm not sure I caught up with
13 where you are. You're on page 964?
14 Q Yes.
15 A Left column?
16 Q Yep.
17 A And you said second full paragraph?
18 Q Yep.
19 A And you didn't start from the very
20 beginning of that paragraph?
21 Q No. Go -- one, two, three, four, five,
22 six, seven -- eight lines from the bottom of that
23 paragraph.
24 A From the bottom. The NbN epitaxial
25 layer --

1 Q Yep.
2 A -- was then obtained. Okay.
3 Q All right. So this is describing a
4 10-angstrom magnesium oxide on silicon dioxide --
5 A Right.
6 Q -- structure; right?
7 A Right.
8 Q And it says that "the mechanism of the
9 epitaxy cannot be explained by the epitaxial
10 growth of magnesium oxide, but rather by the
11 natural orientation or the graphoepitaxy of
12 magnesium oxide." Right?
13 A You read it correctly.
14 Q And then it says, "The possibility of a
15 magnesium oxide graphoepitaxy might be due to the
16 structural surface deformation introduced during
17 the sputter cleaning of the substrate surface."
18 Right?
19 A You read it correctly.
20 Q What is graphoepitaxy?
21 A Well, I can only describe that relatively
22 generally from my level of understanding.
23 Generally this growth of oriented 100 MgO on a
24 variety of surfaces acts like epitaxy in that you
25 get oriented more or less single crystal MgO.

1 However, when the substrate is something like
2 SIL-2, an amorphous substrate, it's not standard
3 crystal epitaxy. It's got something to do with
4 shape. My understanding of epitaxy is relatively
5 limited. I understand it to mean even on an
6 amorphous substrate, you get this oriented
7 crystallographic growth of the MgO by some -- some
8 kind of mechanism having to do with the way that
9 the MgO grains interact or something. I don't
10 really understand the detailed mechanism of
11 graphoepitaxy of MgO. Just that it grows on --
12 even on a noncrystalline surface.
13 Q So you're saying the graphoepitaxy is a
14 property of the magnesium oxide; is that right?
15 A It appears to be -- largely the property
16 of the magnesium oxide, since it occurs on a
17 variety of substrates.
18 Q Then why does Tonouchi say that it might
19 be due to structural surface deformations?
20 A I can't answer that question.
21 Q So structural surface deformations means
22 Tonouchi is saying that the substrate was not flat
23 and uniform; right?
24 A Potentially. At some life scale.
25 Q And Tonouchi even says the deformations

1 could have been introduced during sputter cleaning
2 of the substrate surface; right?
3 A Could have been.
4 Q So they really have no idea what explains
5 MgO graphoepitaxy in this sample, do they?
6 A That I think is fair.
7 Q But they think there was structural
8 surface deformations on the substrate, on the
9 silicon dioxide?
10 A Might be. They say might be. They don't
11 know that it's there. They say might be. They
12 certainly don't offer any experimental data about
13 that.
14 Q So, Dr. Bokor, if it was known in the art
15 that magnesium oxide would form with a 100
16 orientation on any amorphous substrate, why would
17 it be necessary to talk about surface deformations
18 at all to explain that result?
19 A I don't know. I mean, this is
20 speculation. You know, this -- this type of
21 materials growth and analysis is a really
22 complicated business. You know, one thing that I
23 like about the Petroff reference that Dr. Ross
24 cited was that if you read that reference, you get
25 a really good sense for how complicated this

1 business is. And the literature is full of
2 statements, reports that are, you know, such as
3 this Tonouchi, where people observe things and
4 they're not able to really explain them all the
5 way down to the absolute, you know, littlest
6 atomic, chemical level detail because it is so
7 complicated. People speculate all the time in the
8 literature to try to explain a result that they
9 may have. And sometimes the explanations are
10 pretty well-founded. Sometimes the explanations
11 are pretty speculative. And it is very hard to
12 judge. So I don't know what he meant by this. I
13 don't know how -- how -- how seriously to take
14 this statement about surface structural
15 deformation. I don't know a lot about sputter --
16 about the effect of sputter cleaning on silicon
17 dioxide to tell you exactly how much roughness you
18 get, what the spatial scale of the roughness is.
19 That all -- that all would play a role. So I
20 don't know how to -- you know, I don't know how to
21 take this statement. I don't know how much
22 validity to give it. It is a speculative
23 statement. And so I don't think it has a whole
24 lot of probative value, frankly.
25 ATTORNEY WICHMAN: All right. Thank you,

1 Dr. Bokor.
2 Ms. Arnold, I'll pass the witness.
3 ATTORNEY ARNOLD: We would like to go off
4 the record for ten minutes. So 30 -- 30 minutes
5 past the hour.
6 ATTORNEY WICHMAN: Half past the hour?
7 Okay. Off the record.
8 (A recess was taken.)
9 ATTORNEY ARNOLD: We have no further
10 questions. So we just reserve the right to read
11 and sign.
12 ATTORNEY WICHMAN: Great. Off the
13 record.
14 (The proceedings concluded at 3:30 p.m.)
15 -oOo-
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18
19 I have read the foregoing deposition
20 transcript and by signing hereafter, subject to any
21 changes I have made, approve same.
22
23 Dated: _____
24
25

1 _____

(Signature of Deponent)

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1 DEPOSITION OFFICER'S CERTIFICATE

2

STATE OF CALIFORNIA)

3) SS.

COUNTY OF RIVERSIDE)

4

5 I, BROOKE SILVAS, a certified shorthand

6 reporter for the State of California, do hereby

7 certify:

8 That prior to being examined, the witness

9 named in the foregoing deposition solemnly stated to

10 testify to the truth, the whole truth, and nothing but

11 the truth;

12 That the said deposition was taken down by me

13 remotely in stenotype at the time and place therein

14 stated and thereafter reduced to typewriting under my

15 direction, and that the deposition transcript is a

16 true and correct record of the proceedings here held.

17 I further certify that I am not of counsel or

18 attorney for any of the parties hereto or in any way

19 interested in the event of this cause and that I am

20 not related to any of the parties thereto.

21

22 Dated: October 31, 2025

23

24 Brooke Silvas

_____

BROOKE SILVAS

25 CSR No. 10988

1 DEPOSITION OFFICER'S CERTIFICATE

2

3 STATE OF CALIFORNIA)

) SS.

4 COUNTY OF RIVERSIDE)

5

6 I, Brooke Silvas, hereby certify:

7 I am the deposition officer that

8 stenographically recorded the testimony in the

9 foregoing deposition.

10 Written notice pursuant to Code of Civil

11 Procedure, Section 2025.520(a), having been sent, the

12 deponent took the following action within the allotted

13 period with respect to the transcript of the

14 deposition:

15 ( ) In person, at the office of the

16 deposition officer, made the changes set forth on the

17 original of the transcript. (The parties attending

18 the deposition have been notified of said changes.)

19 ( ) Approved the transcript by signing it.

20 ( ) Refused to approve the transcript by

21 not signing it.

22 ( ) By means of a signed letter, made the

23 changes and approved or refused to approve the

24 transcript as set forth therein. (Said letter has

25 been attached to the original transcript and copies

1 thereof mailed to all parties attending the
2 deposition.)
3 ( ) Failed to approve the transcript within
4 the allotted time period.
5
6 Dated: October 31, 2025
7
8 Brooke Silvas
_____
BROOKE SILVAS
9 CSR NO. 10988
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