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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.,

Petitioner,

v.

NINGDE AMPEREX TECHNOLOGY LIMITED,

Patent Owner.

Case IPR2025-00524

U.S. Patent No. 12,015,118

REMOTE DEPOSITION OF

SAMUEL GIDO, PH.D.

January 12, 2026

Reported by: Susan S. Klinger, RMR-CRR, CSR

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Deposition of SAMUEL GIDO, PH.D., held remotely
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I N D E X

WITNESS

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SAMUEL GIDO, PH.D.

EXAMINATION BY MR. COX

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P R O C E E D I N G S

SAMUEL GIDO, PH.D.,

having been first duly sworn testified as follows:

MR. COX: This is Brady Cox with the law firm of Alston & Bird representing patent owner Ningde Amperex Technology, Limited. I'm joined by my partner, Dan O'Connor. We're ready to proceed.

MS. KELLY: This is Kristina Caggiano Kelly from Sterne Kessler on behalf of petitioner CosMX and the witness.

I'm joined by my colleagues Jason Eisenberg and Brian Piccione.

EXAMINATION

BY MR. COX:

Q Good morning, Dr. Gido.

A Good morning.

Q We spoke at your deposition about a couple of months ago; is that correct?

A That's my recollection.

Q And that was in connection with a different IPR proceeding?

A I believe so, yes.

1 Q And that IPR proceeding, like this one,
2 was an IPR proceeding brought by Zhuhai CoxMX
3 Battery Company, Limited against my client Ningde
4 Amperex Technology Limited?

5 A Yes.

6 Q And if I say Amperex or ATL or patent
7 owner, will you understand that I'm referring to
8 Ningde Amperex Technology, Limited today?

9 A Yes.

10 Q And if I refer to CoxMX or petitioner, you
11 will understand that I'm referring to Zhuhai CoxMX
12 Battery Company Limited?

13 A Yes.

14 Q And am I saying CoxMX correctly? Do you
15 have a different way you use it or pronounce it?

16 A That is okay with me.

17 Q And could you state your full name for the
18 record?

19 A Samuel P. Gido.

20 Q And are you taking this deposition from
21 home today, Dr. Gido?

22 A I am. Hopefully we have better luck with

1 the internet although there are no guarantees.

2 Q Understood. And just to confirm, no one
3 else is in the room with you?

4 A No one else is in the room, no one else is
5 in the house.

6 Q Do you have any means of communication
7 open, chat program, Outlook --

8 A No, I don't.

9 Q -- hologram?

10 A I mean, I -- I do have my phone over on
11 the side, but it is, you know on silent. And that
12 was debatable whether I should even bring it in
13 the same room, but I ended up needing it for that
14 two-factor authentication, so yeah.

15 Q Understood.

16 A I can shut it down if you would prefer.

17 Q No, I think that is fine. I just ask that
18 you not use it to communicate with counsel while
19 this deposition is proceeding unless you have to
20 talk about some privilege.

21 A Right, okay.

22 Q Do you have any notes with you today?

1 A I do not. I do, however, have sheets of
2 plain paper and a pen in case I need to make any
3 notes, and in fact, I have made one note which is
4 my password.

5 Q Your password. I was going to ask exactly
6 that question.

7 Today's deposition relates to the
8 proceeding IPR2025-00524. Is that your
9 understanding?

10 A I am not up on the, you know, numbers of
11 the cases, per se, but if we looked at the -- one
12 of the documents, the petition or a response or
13 something, I could confirm that.

14 Q Sure. If you want to open up what is
15 labeled as Paper Number 1 in the exhibits?

16 A Okay. Oh, I see Paper Number 1. So yes,
17 this is case ending in '524. That is for the '118
18 patent, that is my understanding of what we're
19 doing here.

20 Q Thanks. And by the '118 patent, you are
21 referring to U.S. Patent 12,015,118?

22 A Yes.

1 Q And you are okay if I also refer to that
2 as the '118 patent today?

3 A Yes.

4 Q And do you recognize Exhibit 1010 as a
5 declaration that you prepared in connection with
6 that IPR petition?

7 A 242 pages, that looks about right. Yes,
8 it appears to be.

9 Q And on the final page, that is your
10 signature, correct?

11 A Yes.

12 Q Are you -- are you currently aware of
13 anything in this declaration that is inaccurate or
14 in need of correction?

15 A No.

16 Q Okay. If you identify anything as we're
17 looking through your declaration or other things
18 today, will you please let me know --

19 A Yes.

20 Q -- that is an error?

21 Do you recall about how much time you
22 spent preparing this declaration?

1 A It was -- I don't know, you know, maybe
2 almost a year ago. I could look back at my
3 billing, but I would say preparing one of these
4 typically -- typically might -- I might work on it
5 for -- on and off for about a month maybe and
6 might spend something like 30 to 50 hours on it.

7 Q And did you write this declaration
8 yourself?

9 A I wrote technical parts myself pretty much
10 completely and then there were parts that were
11 more legally based like legal standards and so
12 forth, which I obviously had assistance from
13 counsel.

14 Q On pages 11 and 12 of your declaration,
15 Exhibit 1010, there is a list of exhibits of
16 record that you considered in preparing your
17 opinions; is that correct?

18 A Let me get there.

19 Q I guess that is PDF pages 28 and 29.

20 A Yes, yes.

21 Q Are there any documents that you reviewed
22 in preparing your opinions that are not reflected

1 in these exhibits?

2 A Not as I sit here today I can't identify
3 anything.

4 Q Okay. Exhibit 1001 is the '118 patent we
5 will be talking about today, correct?

6 A Do you want me to open that?

7 Q Yes, please. Just confirm it is the right
8 exhibit, right number.

9 A Okay. Hang on one second, 1001. Yes,
10 this looks like the '118 patent.

11 Q As part of your review of the '118 patent,
12 did you carefully review the patent claims that
13 are challenged in the petition?

14 A I did.

15 Q And did you understand each of the patent
16 claims when you prepared your declaration?

17 A I did.

18 Q On pages 28 to 30 you provide certain
19 opinions about claim construction, correct, and
20 this is of Exhibit 1010, your declaration?

21 A 28 to 30 being a PDF or the bottom of the
22 page?

1 Q The bottom of the page numbers. I will
2 try to be careful. If I mean the PDF, I will say
3 PDF page number.

4 A Okay. So just -- the PDF page numbers are
5 more useful to me obviously finding things
6 quickly, but, you know, however you like.

7 Q Yes, so I'm referring to PDF pages 45 to
8 47.

9 A Yes. So yes, this -- this section is on
10 claim construction.

11 Q And you provide opinions about two claim
12 terms in this section, correct?

13 A Let's see. I do.

14 Q And the first term that you provide
15 opinions regarding is the term "compaction
16 density" found in claims 1, 10 and 19?

17 A Yes.

18 Q What is your understanding of the term
19 "compaction density" in the '118 patent?

20 A Well, the compaction density, as it says
21 here, is -- refers to the density of the electrode
22 active material including all components after it

1 has been subjected to a compression step. And
2 density is mathematically or scientifically
3 defined as mass per unit volume.

4 Q And if the construction of compaction
5 density was found to be something else, would that
6 alter your opinions?

7 A It depends on how different it is and the
8 specific situation. It could. It might not,
9 might.

10 Q Am I correct in understanding your
11 opinions to say that the density of a given active
12 material before it is applied in the first layer
13 or the second layer is not the same as the
14 compaction density?

15 MS. KELLY: Object to form.

16 A What the patent is referring to as the
17 compaction density and the way I am construing it
18 is after the layer has been applied and compacted.

19 Q And when you say "the layer," are you
20 referring to the first layer or the second layer
21 of the claims?

22 A Any -- yeah, any cathode layer that is

1 being discussed.

2 Q And how is that compaction density
3 measured after compaction has occurred?

4 A Well, it can be measured by weighing the
5 -- the weighing a sample, and then also observing
6 its volume, right and dividing mass by volume.

7 Q How is the volume measured?

8 A In these cases, you can measure the
9 thickness of a given area on top of the --
10 whatever you have coated it on.

11 Q After compaction is porosity reduced to
12 zero?

13 A Generally not.

14 Q And why not?

15 A Well, a couple of reasons. One is that
16 just as a practical matter you probably couldn't
17 compress it completely to zero without damaging
18 the layer. And secondly, you need room in the
19 layer for the electrolyte, so you need porosity in
20 the layer.

21 Q And can you explain why you need porosity
22 in the layer for the electrolyte?

1 A Well, yeah, because the way that the
2 battery works is that lithium ions basically have
3 to come and go out of that layer during the
4 cycling of the battery. And if they can't get in
5 and they can't access the active material, because
6 there is no pathways, there is no porosity, then
7 the battery won't work.

8 Q What is the minimum amount of porosity
9 required in an active layer?

10 A I don't have a specific number in mind. I
11 mean, there are tradeoffs, but certainly more than
12 about 10 percent I would say.

13 Q Would it be more than 15 percent?

14 A I'm not sure. I would -- certainly --
15 certain aspects of the battery like the rate
16 performance will be better if you have higher
17 porosity. So as you reduce the porosity, certain
18 characteristics like that degrade. So there is
19 some lower value, but you know, these are
20 tradeoffs.

21 Q Would the desired porosity ever be less
22 than 10 percent?

1 MS. KELLY: Object to form.

2 A I couldn't -- I mean, I couldn't speculate
3 on what people might be trying to do, but -- yeah,
4 I couldn't speculate on that.

5 Q Is it fair to say that the acceptable
6 amount of porosity depends on the desired
7 characteristics and tolerances and goals of a
8 given battery?

9 MS. KELLY: Object to form.

10 A Yes.

11 Q You also discuss a term "average particle
12 size."

13 A Yes.

14 Q What is your understanding of the term
15 "average particle size"?

16 A Well --

17 Q As in -- I apologize, as used in the '118
18 patent?

19 A Right. Well, the particles are not all
20 the same size. It is not a mono dispersed size of
21 sample. There is a distribution of sizes and the
22 average particle size is an average that is taken

1 of that distribution. And as defined in the '118
2 patent, they specifically say is a type of average
3 called Dv50.

4 Q And what is Dv50?

5 A That is the 50 percent volume average
6 value. It is also the median of the volume
7 distribution of particles.

8 Q Is that different from the median particle
9 size?

10 A It is different from the number-based
11 median. I mean, there could be a volume-based
12 median or a number-based median or a surface area
13 based median. It is the middle of the
14 distribution on whatever basis you are looking at
15 the distribution or representing the distribution.

16 Q Is it fair to say that average and median
17 are not always necessarily the same value?

18 A I mean, you know, just in general
19 statistics, they are not necessarily. So the
20 median is the average value in a distribution --
21 or is the middle value in a distribution and the
22 average is basically adding up all of the values

1 in the distribution with some kind of a weighting
2 factor, which could just be their number or could
3 also be volume or something and dividing by the
4 number that are there.

5 So they're statistically not exactly the
6 same thing, but in this particular patent, in the
7 '118 patent, they are defining Dv50 as an average
8 in a way that it is basically the median of the
9 volume distribution.

10 Q For every other claim term in the '118
11 patent, is it fair to say that you applied the
12 ordinary and customary meaning of the term?

13 A Yes.

14 Q Did you interpret the term "first
15 material" to refer to first active material in
16 your opinions?

17 A That is used kind of differently in and
18 interchangeably in, I think, in some of the prior
19 art. So sometimes when they're referring to the
20 first material, they're referring to all
21 components in a particular -- in the first layer,
22 and sometimes they are referring only to the

1 active material, and sometimes they say the first
2 active material, but sometimes they don't.

3 And so you would have to look at every --
4 every instance.

5 Q In the '118 patent itself in claim 1, you
6 see there is two claim limitations and that is in
7 Exhibit 1001, PDF page 12, that say a first layer
8 comprising a first material and a second layer
9 comprising a second material?

10 A I see that.

11 Q When you interpreted these claims, did you
12 interpret the terms, a first layer comprising a
13 first material and a second layer comprising a
14 second material, to mean a first layer comprising
15 a first active material and a second layer
16 comprising a second active material?

17 MS. KELLY: Object to form.

18 A Yes, I -- I did end up interpreting it
19 that way, because for instance, later on in claim
20 1 we're talking about the particle size of the
21 first material. So it is obviously referring to
22 the -- to the particles.

1 Q Do you understand what the word
2 "comprising" means in the context of patent
3 claims?

4 A Well, I mean, I -- I'm not an attorney,
5 but to the extent that I have experience working
6 with patents, I believe that I have at least a
7 layman's understanding or a POSA's understanding.

8 Q What -- what is your understanding of the
9 meaning of the term "comprising" in a patent
10 claim?

11 A Comprising means that that component is in
12 there, but it doesn't mean that it is exclusively
13 in there. Other things can be in there as well.

14 Q So is your understanding of a first layer
15 comprising a first material mean that the first
16 layer must comprise a first material but it may
17 also comprise other things?

18 A Yes.

19 Q And the same is true of the second layer?

20 A Yes.

21 Q Where in your report do you provide an
22 opinion that says a first layer comprising a first

1 material means a first layer comprising a first
2 active material?

3 MS. KELLY: Object to form.

4 A Where in my report?

5 Q Or your declaration rather?

6 A Right. Well, okay. Repeat -- repeat that
7 again.

8 Q Where in your declaration do you provide
9 an opinion that says a first layer comprising a
10 first material means a first layer comprising a
11 first active material?

12 MS. KELLY: Object to form.

13 A Well, I mean, that -- that is in --
14 certainly in all of the different grounds that I
15 presented. There are claim elements. You know,
16 that particular claim element is addressed for the
17 different prior art, and I believe that I identify
18 active materials in those two layers.

19 Q The patent claims include a first material
20 and a second material, correct?

21 A That's what it says, yes.

22 Q Must those be different materials?

1 A My understanding -- I mean, it depends on
2 what you call -- what the difference is, what --
3 what constitutes difference. Different chemical
4 composition, different size distribution, I mean,
5 what are we -- what differences are you talking
6 about?

7 Q Any or all of those. Must the first
8 material and the second material be different
9 materials?

10 A They generally are in the '118 patent
11 although it is possible that they could be the
12 same I think, because for instance, there is
13 considerable overlap in the Markush groups of
14 claims 7 and 8. So they could be the same --
15 chemically the same active material. You know,
16 part of the patent is about differences in
17 particle size. Although in Claim 3 we see that it
18 is possible for the ratio of the size of the
19 second material to the first material to be
20 one-to-one.

21 So I don't know whether I have gone
22 through every different possibility here, but

1 generally they are different in some way, but it
2 is possible for them to be the same, I think.

3 Q If they are the same chemical composition
4 and the same particle size, are there two layers
5 or is there just one thicker layer?

6 A Well --

7 MS. KELLY: Object to form.

8 A Well, the patent teaches putting down two
9 layers, first of all. So you know, that is like
10 painting something. You put two coats of paint on
11 and it is the same paint, are there two layers or
12 is it one layer of paint? And I think probably a
13 person would say there are two layers.

14 Additionally, they may be compressed
15 differently, so even though the materials are the
16 same they may have same -- different densities.

17 Q Anything else? It sounds like you weren't
18 done so I'm -- are you done with your response?

19 A I'm -- I'm done.

20 Q Okay. So -- so that I understand your
21 opinions correctly, you believe the second
22 material may be the same material as the first

1 material with respect to the '118 patent claims?

2 MS. KELLY: Object to form.

3 A You know, I would say that I haven't
4 really thought about this in detail. So there
5 might be something lurking in here that prevents
6 that, but my understanding of the claims would
7 suggest that that could be possible.

8 Q Could you open up Exhibit 2044?

9 A Let's see, 2044, okay.

10 Q Have you seen this document before?

11 A I have, because when you dropped it, you
12 said these are all documents that were in the
13 record or whatever except for 2044, so I said what
14 the heck is 2044. But other than that -- so I was
15 looking at this and I'm trying to remember.

16 This has something to do with ongoing
17 district court litigation involving some of these
18 patents and this appears to be particularly --
19 maybe particularly about '118, at least I'm seeing
20 -- no, I'm seeing actually a number of patent
21 numbers in here. So this is some document related
22 to that and I really don't remember whether I

1 have, you know -- I may have been sent this. I
2 was sent a lot of stuff. I wouldn't say that I
3 have studied this yet.

4 Q Understood. And I will represent to you
5 that this is CoxMX's responsive claim construction
6 brief that was filed in the underlying district
7 court litigation on December 16th, 2025.

8 And without getting into any
9 communications you have had with your counsel or
10 privileged communication with CoxMX, are you
11 assisting in any way with the district court
12 litigation?

13 A I am, although I will say that if this --
14 if the date on this document is in -- you said
15 December?

16 Q That's right?

17 A 2025?

18 Q Yes, less than a month ago.

19 A Yeah, then I haven't -- I haven't seen it.

20 Q Okay. And you had no involvement in the
21 preparation of this document or these arguments?

22 A I am not sure, I don't believe I did. I

1 mean, I have had general -- general conversations
2 with counsel over the last, you know, I don't
3 know, maybe six months or more about various
4 things. And whether I said something that made
5 its way in here, I can't -- I can't know, but --

6 Q Understood, and I --

7 A -- I didn't -- I didn't work on -- I did
8 not work on this document.

9 MS. KELLY: Yeah, I think -- I think we're
10 getting into privilege, so I think --

11 Q Yeah. I don't want any privileged
12 communications with your counsel for sure.

13 On pages 21 to 29 and that is PDF pages 28
14 to 36 there are arguments about the construction
15 of the term, "a first layer comprising a first
16 material." Do you see that?

17 A Okay, yeah. Okay, so --

18 Q And this --

19 A Yeah.

20 Q -- section argues that, the claims show
21 that the claimed first material must necessarily
22 be a first active material, correct?

1 A Yeah, I mean, I did not read the whole
2 thing. I'm not a speed reader, I'm a little bit
3 dyslexic, but I did manage to get through maybe a
4 page here. And that seems to be what it says at
5 least early on in this -- in this section.

6 Q I may have sort of asked this earlier, but
7 is that understanding of the term, "first material
8 meaning first active material," the understanding
9 of the term that you applied in your declaration?

10 A In my declaration in this IPR that we're
11 talking about?

12 Q That's right.

13 A Yes.

14 Q Is there a reason that you did not address
15 that in the claim construction section of your
16 declaration?

17 MS. KELLY: Object to form.

18 A I think that, you know, a POSA reading the
19 patent it would be clear to them that, you know,
20 what is being discussed as the first material and
21 the second material are the active materials. If
22 nothing else, then because of the lists of

1 materials that are given, I believe, in the
2 specification and also in the claims for the first
3 and second materials.

4 Q And so it is your belief that those
5 embodiments that are shown are the only possible
6 meaning of first material?

7 MS. KELLY: Object to form.

8 A Yeah. I did not do any kind -- I didn't
9 think, you know, or analyze, you know, that kind
10 of particular, you know, limit on the
11 construction. I mean, I -- it was clear -- it was
12 fairly clear to me -- it was very clear to me what
13 the patent was talking about when it was talking
14 about the first material and the second material,
15 that these were the active materials. And it did
16 not really occur to me to think, well, let's
17 investigate the boundaries of what could be a
18 first material if it is not an active material,
19 whether that would even be valid.

20 I -- I gave that no thought in -- in my
21 analysis.

22 Q You will agree with me that there are

1 materials that are not active materials?

2 A Oh, yes, of course.

3 Q And that the plain meaning of the term
4 "material" includes but is not limited to active
5 materials?

6 A Yes.

7 Q Do you recall submitting a CV in this
8 proceeding?

9 A I did.

10 Q And that is shown as Exhibit 1011?

11 A Hold on a second, yes.

12 Q Have there been any material updates to
13 your CV regarding battery technologies for
14 lithium-ion batteries since this CV was submitted?

15 A No.

16 Q Have you had any experience in battery
17 construction?

18 A My experience with batteries has mainly
19 been producing the polymer materials that are used
20 as binders. I'm a polymer scientist, and these
21 are then used to make -- construct batteries by
22 collaborators that I work with that actually make

1 devices. So I've been involved, I've, you know,
2 seen it done. I have not done it with my own
3 hands.

4 Q When you say, polymer materials that are
5 used as binders, for what structures in the
6 battery are the polymer materials that you have
7 worked on used?

8 A For both the separators and the
9 electrodes. Fluorinated polymers, for instance,
10 are used in -- as binders in both electrodes and
11 in the separator in certain instances.

12 Q Do you have any experience in creating or
13 constructing active material layers for a cathode?

14 A I have made polymer binder materials that
15 have been used to make active materials for a
16 cathode. I didn't do it with my own hands.

17 Q You are saying that the polymer materials,
18 the polymer binder materials that you created,
19 were used to make active materials for a cathode
20 or used to bind active materials in a cathode?

21 A To bind.

22 Q And so fair to say those polymer materials

1 that you are discussing were not themselves active
2 materials?

3 A No.

4 Q Have you created any active materials for
5 use in a cathode?

6 A No.

7 Q And have you constructed any active
8 material layer yourself?

9 A I have been involved in studies using
10 polymers that I created to make active material
11 layers, but I did not make those layers myself.

12 Q Have you participated in any compaction of
13 any active material layer?

14 A Again, the active material layers that
15 included materials that I made, binder materials
16 that I made were compacted. I didn't compact them
17 myself.

18 Q Do the compaction characteristics of an
19 active material layer depend more on the active
20 materials or on the polymer?

21 MS. KELLY: Object to form.

22 A It is a composite structure. It is really

1 hard to, you know, separate them, but certainly
2 the particle size and particle size distributions
3 depends on that or influences that as does the
4 binder. How much of the binder is in there, what
5 are the viscoelastic properties of the binder and
6 so forth.

7 Q Is it fair to characterize binder
8 materials in an active layer as typically having a
9 lower density than the active materials?

10 A Yes, generally, yes.

11 Q And do you know why that is?

12 A Well, polymers typically have -- if
13 they're hydrocarbon polymers, they typically have
14 densities of about 1. A lot of these binder
15 materials have other kinds of elements in there
16 like fluorene or oxygen, which can increase the
17 density, but typically would not be able to get a
18 density above 2.

19 Q And when you say density of 1 or 2, would
20 you do me a favor and put a unit on that?

21 A Grams per cubic centimeter.

22 Q And that is a mass per volume measurement?

1 A It is.

2 Q Did you ever receive a master's degree or
3 did you go straight from your bachelor's degree to
4 your Ph.D.?

5 A I went straight from my bachelor's degree
6 to my Ph.D.

7 Q And both your bachelor's degree and your
8 Ph.D. are in the fields of chemical engineering,
9 correct?

10 A Yes, nominally -- nominally, yes.

11 Q Fair to say -- fair to characterize your
12 Ph.D. education as focused on polymers?

13 A Yes.

14 Q In your Ph.D. program, did you study
15 lithium-ion batteries?

16 A No. And in fact, my Ph.D. program
17 predated lithium-ion batteries --

18 Q In your Ph.D. program, did you study --

19 A -- or at least -- or it was coincident
20 maybe with the invention of them.

21 Q In your Ph.D. program, did you study
22 batteries at all?

1 A No. I basically did basic studies of --
2 of polymer materials for whatever application you
3 want to apply them for.

4 Q In your bachelor's program, is it fair to
5 say that you did not have any education or
6 training on batteries or lithium-ion batteries?

7 A Again, that -- that really predates
8 lithium-ion batteries. I did work on porous
9 materials, but in a different -- not in that
10 context.

11 Q At what stage in your career did you
12 receive education or experience with respect to
13 lithium-ion battery construction?

14 A Early 2000s I would say about.

15 Q And in what form did you receive that
16 education or experience?

17 A Well, I got -- I did a lot of work for the
18 US Army and they wanted me to work on materials
19 for lithium-ion batteries in about that timeframe.
20 And also I had interactions with some companies,
21 particularly Kureha, which is a Japanese company
22 that makes materials for batteries and those

1 interactions started in the early 2000s, I
2 believe.

3 Q And were those interactions regarding
4 polymers exclusively for batteries?

5 A Well, my involvement was making polymers
6 and supplying polymers, because that is what --
7 yeah, I'm a polymer scientist.

8 Q Is it fair to say that your contribution
9 or interaction was not about the active materials
10 for batteries?

11 A Well, it was about the binders that are
12 used with the active materials. So it is a
13 overall product and overall effort, but yes, I was
14 supplying the polymers.

15 Q Have you ever been consulted with or
16 yourself advised anyone or any company on how to
17 perform compaction of a cathode layer?

18 A Only to the extent that I gave advice on
19 how the polymer binder that we had prepared might
20 interact as part of that process.

21 Q And for all the discussions that you have
22 discussed with me about polymer for uses in

1 battery, you have been discussing that polymer for
2 polymer binder, correct?

3 A Yes.

4 Q In any of the roles listed on page 1 of
5 your CV, have you designed a lithium-ion battery?

6 A Only, again, in my role as a faculty
7 member at UMass have I supplied materials, polymer
8 materials, that were used in lithium-ion batteries
9 and provided advice, you know, related to the use
10 of specifically the polymers in those
11 applications.

12 Q Are you currently working on any projects
13 today that relate to battery technologies or
14 lithium-ion batteries?

15 A No. I am almost 60 years old and I'm kind
16 of winding down at least, you know, the academic
17 research side, so not anymore.

18 Q Have you taught any courses about
19 batteries?

20 A I have incorporated battery technology and
21 materials used in batteries into courses that I
22 teach. There is, you know, no courses in our

1 curriculum in the polymer science department
2 specifically on batteries, but I have talked about
3 in physical chemistry of polymers, morphology of
4 polymers. And also, in fact, in a freshman
5 seminar that I teach which, you know, I give one
6 seminar on batteries. The students love the
7 exploding nail tests and things like that, so...

8 Q Is it fair to say that those courses or
9 those seminars are discussing the polymer
10 materials in the batteries, for example, the
11 separator or the binder?

12 A They are discussing the batteries overall,
13 which necessarily include all components. But
14 again, these are polymer courses, polymer physical
15 chemistry, polymer morphology, and so the focus is
16 on the polymer components.

17 Q Do you hold any patents related to
18 batteries?

19 A I have a patent on fluorinated and
20 sulfonated copolymers, which have been used in
21 batteries and fuel cells.

22 Q But they're not exclusively used for that

1 function?

2 A There are other applications as well.

3 Q What are some of those other applications?

4 A For instance, water purification
5 membranes.

6 Q Have you ever used laser diffraction to
7 measure the size of any particles?

8 A I have.

9 Q And what types of particles have you
10 performed laser diffraction on?

11 A Typically that is done on, in our case,
12 polymer nanoparticles. Sometimes also some
13 inorganic material nanoparticles that we were
14 interested in for, like, their magnetic
15 properties.

16 Q Have you performed laser diffraction on
17 any active materials for a battery?

18 A I have not at UMass. Again, the people
19 that I've worked with to make batteries do that,
20 but I have not done it at UMass.

21 Q Will you explain how laser diffraction
22 works to determine particle size?

1 A Yes. Yes. So a particle produces -- each
2 particle produces a diffraction pattern, a
3 scattering pattern which kind of actually looks a
4 bit like -- like a target, like, for archery or
5 shooting of some sort.

6 There is, I believe, a picture of that
7 kind of thing in a couple of references. There is
8 a -- there is an ISO standard, I think, that I
9 referenced, and there is also some kind of an
10 Anton Paar website that I think maybe Dr. Wheeler
11 used. And they -- they show that kind of a
12 pattern.

13 And each particle will produce a pattern
14 like that. And the location of the maxima and
15 minima in that -- of intensity in that target as
16 you go radially outward is related to the size of
17 the particle. Basically the bigger the particle
18 is the more closely spaced those rings of the
19 target are.

20 And what happens is that, however, if you
21 have got a distribution of these particles, they
22 -- each size, each type -- each size of particle

1 is producing their own target pattern that have
2 these maxima and minima in different places,
3 because they're different sizes. And these all
4 get added together into one pattern, and so that
5 is what the machine detects.

6 And then there is a complicated
7 mathematical process that is used to basically fit
8 the overall scattering of all of these different
9 sizes to a volume distribution of size. So you
10 know, basically all of these particles, they're
11 all different sizes. They're all producing this
12 pattern, but the patterns all get mashed together
13 and you have to mathematically find the volume,
14 distribution of particle sizes that matches that
15 sum of all the individual scatter.

16 So that is how the analysis is done, that
17 is what the machine does.

18 Q What machine do you use at UMass to
19 perform that laser diffraction?

20 A I would have to go online and look up the
21 name of the thing. It is in a facility called
22 I-A-L-S, IALS. Institute for -- Institute for

1 Life Sciences, Institute for Applied Life
2 Sciences, IALS.

3 And there is a -- there is a instrument as
4 part of the shared facilities for the university
5 there, that is what I have used. I don't know
6 whether you can go online and find that.

7 Q Are you aware of the different ways that
8 particle size distributions can be reported?

9 A Yes.

10 Q A volume-based distribution is one way in
11 which particle size distribution can be reported,
12 correct?

13 A That is the way that the -- that is what
14 the machine determines.

15 Q Is it your position that a laser
16 diffraction machine cannot output a number-based
17 particle size distribution?

18 A It doesn't. So what it does is it fits a
19 -- you know, I think I was reading Dr. Wheeler's
20 declaration where there was some discussion of,
21 well, the machine uses volume to calculate a bunch
22 of diameters. And then you can average these or

1 represent these either as a number-based or a
2 volume-based distribution and that is actually not
3 the way it works.

4 The machine does not give you a list of
5 diameters of all the particles. It simply fits an
6 overall volume distribution to match the overall
7 scattering of all the particles as I explained in
8 what I -- as I explained when I explained this.

9 If you want to convert from that volume
10 distribution to some other distribution, you have
11 to do a complicated calculation which also
12 requires assumptions about the particles, about
13 their shape, for instance.

14 MR. COX: Objection, nonresponsive.

15 Q My question was, is it your position that
16 a laser diffraction machine cannot output a
17 number-based particle size distribution?

18 A It cannot determine that. I don't know
19 whether, you know, the machine has in it some
20 algorithm that you can use to make assumptions and
21 do an additional calculation on top of what the
22 machine outputs to output numbers. I -- I have --

1 I have never seen that, but it might be possible.

2 Q So you are saying it might be possible for
3 a laser diffraction machine to output a
4 number-based particle size distribution?

5 MS. KELLY: Object to form.

6 A The machine outputs a volume-based
7 distribution. Somebody would have to do an
8 additional calculation making assumptions, which
9 may or may not be justified, to convert that into
10 a number distribution.

11 Whether there is a function on the machine
12 where somebody has already programmed that, I -- I
13 don't know. I don't know why anybody would even
14 want to do that. Number distribution is typically
15 not what people discuss in this field particularly
16 because the common machine that is used for
17 measurement gives volume.

18 MS. KELLY: Counsel, we've been going for
19 about an hour.

20 MR. COX: Sure, yeah, we can take a break.

21 Q I was planning on taking a break like
22 every 80 minutes, but Dr. Gido, if you prefer to

1 go every hour I'm fine to do that as well?

2 A It is okay to take a break now, but just
3 like five minutes. I don't want to drag this out
4 and, you know, I will.

5 Q That is fine.

6 A I will let you know as necessary, but we
7 can take a five minute break now.

8 MS. KELLY: Actually, before we go off the
9 record I had a brief housekeeping thing, just
10 there might be an ambiguity in the transcript. I
11 have -- so you introduced an exhibit, what you
12 called an Exhibit 2044. I think there was already
13 an Exhibit 2024, so we might have two now.

14 MR. COX: 2044.

15 MS. KELLY: 2044, I think there is already
16 an Exhibit 2044, we might have two now.

17 MR. COX: Then I apologize, I can renumber
18 that as 2045, and we can retroactively say that
19 was Exhibit 2045.

20 MS. KELLY: Okay. Also I mean check on
21 your end just in case I'm mistaken.

22 MR. COX: Oh, I think you're right. I

1 think 2044 was my declaration, which was just
2 Friday.

3 MS. KELLY: Okay.

4 Q Okay, yeah. So just for housekeeping,
5 this claim construction brief that we were looking
6 at, Dr. Gido, that was marked as Exhibit 2044, can
7 we agree to call that 2045?

8 A Yes.

9 MR. COX: Okay. I will renumber that and
10 reupload it. Thank you, Ms. Kelly.

11 MS. KELLY: Yes.

12 (Recess, 12:18 to 12:24 p.m.)

13 Q You will agree that there are multiple
14 ways of accumulating a particle size distribution
15 in the art, correct?

16 A Yes.

17 Q And what are those different ways?

18 A Well, there is by number, by volume, by
19 surface area, by mass or weight.

20 Q And as long as we're all on Earth, mass
21 and weight should be the same kind of
22 distribution?

1 A Well, at least on, like, planet Earth at
2 roughly sea level, yes.

3 Q Would you pull up Exhibit 1004?

4 A Okay.

5 Q And is this the Ishigaki reference that
6 you rely upon --

7 A It is.

8 Q In paragraph 83 of your report --

9 A Okay.

10 Q -- you say --

11 A Hold on.

12 Q Sorry, yeah, it is Exhibit 1010.

13 A Now, I've got -- yeah, two different --
14 two different references. Well, and actually only
15 one extra screen unless I want to cover you up,
16 but yeah, okay.

17 So what -- what page of my report.

18 Q It is PDF page 53 and 54.

19 A Okay, yes.

20 Q You say --

21 A Okay.

22 Q -- that there are multiple ways of

1 accumulating the particle size distribution to
2 obtain an average diameter, correct?

3 A That sounds like something I said. I'm
4 not actually finding it here.

5 Q At the top of PDF page 54?

6 A Oh, yeah, okay, sure.

7 Q You said, there are multiple ways of
8 accumulating the particle size distribution to
9 obtain an average diameter, correct?

10 A Yes.

11 Q And then that could be done on a number
12 basis or it could be done on a mass basis or a
13 volume basis, correct?

14 A Yes.

15 Q And you also mention possibly a surface
16 area basis, correct?

17 A Yes, I didn't -- I just mentioned that to
18 you now. I didn't put it in the report, but yes.

19 Q But that is another type of -- that is
20 another way to accumulate particle size
21 distribution to obtain an average diameter?

22 A It could be, yeah.

1 Q Does the determination of an average
2 diameter assume spherical particles?

3 A Usually, yes. The -- the machine that is
4 doing, you know, the fitting basically of the
5 scattering to the volume distribution needs to
6 make some assumptions and it is somewhat opaque
7 what those assumptions are, but it is likely that
8 one of them is about particle shape, yes.

9 Q Ishigaki refers to the median diameter,
10 correct?

11 A Let me -- let me go over to Ishigaki here.
12 Median, well, also I just -- I just searched for
13 median and I'm seeing it, for instance, claim 3 of
14 Ishigaki uses median, okay.

15 Q And on PDF page 15 of Exhibit 1004
16 Ishigaki discusses the median diameter and the 90
17 percent cumulative diameter?

18 A Yes, I see that.

19 Q Can median diameter indicate the median
20 particle diameter by particle count?

21 A Well, it says down in paragraph 39 what
22 Ishigaki means by median diameter as the average

1 particle diameter and 90 -- as the average
2 particle diameter and 90 percent cumulative
3 diameter as measured by a well-known laser
4 diffraction particle size distribution measuring
5 device, which is doing so on a volume standard is
6 what it says.

7 Which, again, a POSA doesn't even have to
8 be told that that is working, you know, with
9 volumes. That is known, because that is the way
10 that device works.

11 Q So it is your contention that median
12 diameter refers to a 50 percent cumulative volume
13 diameter?

14 A 50 percent cumulative by volume.

15 Q I'm sorry, I thought you were asking
16 yourself. That is your answer?

17 A Yeah, well, what -- what did I say? Can
18 the reporter read that back?

19 (Record read.)

20 A Yeah, that is -- that is my answer.

21 Q You believe that median diameter cannot
22 refer to the median diameter by particle number?

1 MS. KELLY: Object to form.

2 A No, I mean, in -- in a general context, it
3 potentially could, but I think that Ishigaki is
4 making it clear that it is working on a volume
5 basis. It says a particle diameter standard is a
6 volume standard at which, you know, the language
7 there is a little awkward, but this is translated
8 from the Japanese, and I don't read Japanese.

9 So but a POSA reading that knowing again
10 what this laser diffraction machine does and the
11 kind of data it outputs would -- would conclude
12 that -- that the median there would be
13 volume-based.

14 Q In your mind, is there any room for
15 ambiguity there?

16 MS. KELLY: Object to form.

17 A I -- I'm just saying what a POSA would
18 believe. So, you know, the conclusion that a POSA
19 would draw would be that it is volume-based. You
20 know, could somebody draw a different conclusion,
21 I -- I doubt it.

22 Q Do you know what laser diffraction device

1 was used by Ishigaki?

2 A It may say in here somewhere down -- I
3 don't recall off the top of my head. This
4 document, you know, is very extensive and I think
5 down at the bottom there are sections that talk
6 about methods, so it -- it might. Let me see.

7 So I've just searched the document for
8 laser and it does not say so. I'm going to search
9 for diffraction. Actually there is too many,
10 because he also uses x-ray diffraction for the
11 active material, so there is too many diffractions
12 to search for.

13 But I don't see -- I don't see in Ishigaki
14 where the specific device is stated. That is not
15 to say it is not in there, but I can't find it.

16 Q It is your position that commercial laser
17 diffraction devices are incapable of outputting
18 particle size distributions on a number basis?

19 MS. KELLY: Object to form.

20 A Yeah, that is not what I said. I said
21 that the device inherently determines a
22 volume-based distribution and it would take a

1 complicated calculation that uses a bunch of
2 assumptions to convert it to a number-based
3 distribution.

4 I do not know whether, you know, the
5 current state of the art in these machines has a
6 button or function you can push to do that
7 calculation. They -- they could, but yeah, I
8 don't -- so I can't make a hard and fast statement
9 either way.

10 Q Do you know what the state of the art in
11 laser diffraction machines was at the time of
12 Ishigaki?

13 A Let's see, the time of Ishigaki. Let
14 me -- 2013?

15 Q Filed 2012, published 2013.

16 A Well, I mean, you know, these machines
17 have worked the same way for years. And they,
18 again, do a volume-based calculation. Whether or
19 not there was a feature available to automatically
20 do some kind of conversion calculation, you know,
21 I don't know.

22 I will say that, you know, I was involved

1 in another IPR one time where we had a prior art
2 that was reporting number-based, for instance, and
3 we wanted to convert to weight-based or
4 volume-based or vice versa, I forget which it was.

5 And I did some calculation in which I --
6 for which I had to make some assumptions. And,
7 you know, that was basically shot down, because
8 for the -- for the reason that it is sort of not a
9 rote mechanical conversion from one thing to the
10 other. You need to make certain assumptions and
11 do certain complicated calculations.

12 Q Do you recall what IPR that was or who the
13 parties were?

14 A That involved, I believe, LG Chem and
15 maybe Molecular Rebar, so yeah.

16 Q And you represented LG Chem in that
17 proceeding or rather, you were hired on behalf of
18 LG Chem in that proceeding?

19 A Yeah, it was good -- I think we went
20 through this in a previous deposition. I don't
21 represent anybody, I -- but yes, I -- I was hired
22 by counsel for LG Chem.

1 Q Are you currently aware of any restriction
2 on you being adverse to Amperex?

3 A No.

4 Q Do you know if Amperex batteries are at
5 issue in that underlying litigation between
6 Molecular Rebar and LG Chem?

7 A I do not.

8 Q Could you describe what the primary
9 components are for a lithium-ion secondary
10 battery?

11 A Sure. I mean, there is a positive
12 electrode, negative electrode, separator. There
13 is an electrolyte. There are current collectors,
14 which are kind of part of the electrodes.

15 Q And when you refer to the positive
16 electrode and negative electrode, is it all right
17 if we call those cathode and anode?

18 A Yes.

19 Q What is the role of a cathode in a
20 lithium-ion secondary battery?

21 A Well, the cathode has an active material
22 which can basically hold lithium ions. And it

1 basically accepts them during discharging and
2 releases them back to the anode during charging.

3 Q Are there different types of active
4 materials?

5 A Yes.

6 Q And do those different active materials
7 have different densities and different other
8 characteristics?

9 MS. KELLY: Object to form.

10 A Yeah, yes. There is some variability.

11 Q What is the purpose of the active
12 material?

13 A Well, that is the material that has a
14 crystal structure which can hold the lithium ions.

15 Q What are some of the most common active
16 materials?

17 A Well, lithium, cobalt, nickel, manganese
18 oxide or let's see, NMC.

19 Q Is the C also cobalt?

20 A Did I say cobalt?

21 Q Well, you said manganese --

22 A Lithium, nickel, manganese -- lithium

1 cobalt, nickel, manganese oxide, I just need to
2 make sure I get them all in there. And then there
3 is also, for instance, lithium iron phosphate.
4 And, you know, there are many others although the
5 NCM (sic) is the one that is actually used a lot
6 in the '118 patent and also in the prior art.

7 Q And you said NCM. Is that traditionally
8 referred to as NMC, nickel manganese cobalt?

9 A Yes, did I -- did I invert those letters?
10 Sorry about that, yeah.

11 Q No worries. Just trying to get a clean
12 record?

13 A Yes.

14 Q How is lithium iron phosphate different
15 from NMC?

16 A Well, it -- it actually is a lower
17 capacity material. So it basically doesn't -- if
18 you use it, you are basically lowering the energy
19 capacity of your battery a little bit although it
20 does have some beneficial characteristics, for
21 instance, as used by Saka.

22 Q Is lithium iron phosphate also a lower

1 density material than NMC?

2 A I think it might be. I don't recall off
3 the top of my head, although I did do some
4 calculations with it. So I would have to look,
5 but it -- it could be.

6 Q Is it true that if you are able to obtain
7 an exemplary compaction density with one set of
8 materials you might not be able to achieve the
9 same compaction density with a different set of
10 materials that themselves have different
11 densities?

12 MS. KELLY: Object to form.

13 A The densities of most of these materials
14 are somewhat similar. They all tend to be in the
15 range of maybe 4, 5, little bit more than 5.

16 So yeah, I mean, it -- it could, you know,
17 it could have that effect. If material is less
18 dense, for instance, if its crystal structure is
19 less dense it could although, you know, probably a
20 bigger factor might be porosity, right. So you
21 could maybe use lighter material, but adjust the
22 porosity a little bit lower.

1 Q Is it always desirable to increase
2 compaction density?

3 A Not necessarily. I mean, it depends again
4 on what you're trying to achieve. You know
5 typically people may be trying to achieve certain
6 characteristics to do with safety or rate
7 performance or something like this which, you
8 know, may have other imperatives, I suppose, on
9 the density.

10 But then there is always sort of an
11 overriding issue that runs through any adjustments
12 you make that you don't want to have the density
13 get too low, because that will potentially have
14 the energy density of the battery getting too low.

15 Q If you increase the compaction density and
16 reduce the porosity for a given set of materials,
17 does that impact the charging rate and discharge
18 rate?

19 A It could, yes.

20 Q Would a lower compaction density increase
21 rate performance?

22 A Potentially, yes.

1 Q And a higher density conversely would
2 decrease rate performance?

3 A Potentially, yes.

4 Q Do you know what the density of lithium
5 iron phosphate is?

6 A Not off the top of my head. I think it
7 might be lower than NMC.

8 Q Did you address the density of lithium
9 iron phosphate anywhere in your report?

10 A I think I may have, because I did some
11 calculations for Saka using it, so although I
12 don't know whether I quoted it in the report
13 itself. I think that there was also some kind of
14 an Excel spreadsheet that was produced as an
15 exhibit to that report. Let me see.

16 Q Are you referring to Exhibit 1007?

17 A Well, yes. Okay, so I've opened Exhibit
18 1007 and there we have the densities. So yes, NCM
19 (sic) 4.8, LFP 3.6 grams per CC.

20 Q Fair to say that the density of LFP is
21 about 75 percent of the density of NCM (sic)?

22 A I'm not doing the math in my head here,

1 but it certainly is lower and that might be about
2 right.

3 Q Where did you obtain these densities?

4 A I don't recall. I did this, you know, I
5 don't know, probably almost a year ago. I'm --
6 I'm sure I -- I did an online search and found
7 some kind of a -- you know, it will pop something
8 up, but then you can go and look at the underlying
9 reference so this is coming from some kind of a
10 handbook or something probably.

11 Q Is it fair to say that a POSITA would
12 expect the compaction density of an active layer
13 containing lithium iron phosphate to be lower than
14 the density for an active layer containing NMC all
15 else being equal?

16 A All other things being equal, that is how
17 much you compressed it, and things like that.
18 Well, also not necessarily. It depends on the
19 relative sizes of the particles. So for instance,
20 if the LFP particles are small enough that they
21 can fit in between the NCM particles -- you know,
22 basically adding a lighter material like a lighter

1 active material or a polymer binder or carbon
2 black or anything like that, will increase the
3 density to the extent that if you add it it also
4 increases sort of the nominal overall dimensions
5 of the layer by the same amount that, you know,
6 you added.

7 But if it goes into, like, nooks and
8 crannies basically and doesn't increase the
9 overall volume or doesn't completely increase the
10 overall volume by the volume you add then it might
11 not, so you know, it depends.

12 Q Why would a battery designer choose NMC
13 over lithium iron phosphate?

14 A Well, it is a higher capacity active
15 material.

16 Q Any other reasons?

17 A Well, I mean that is my understanding as
18 to why NMC is used a lot in the -- in this art.

19 Q And by higher density are you referring to
20 not only to, you know, mass by volume density but
21 also the density of lithium ions?

22 MS. KELLY: Object to form.

1 A To the extent that -- I am not sure about
2 that actually. I would have to look at the
3 chemical structures. And certainly different NCMs
4 have different amounts of lithium complex, but
5 generally I think that would be the case, yes.

6 Q Are you aware of any other reasons why a
7 POSITA would choose lithium iron phosphate over
8 NMC?

9 A Well, I mean, Saka, for instance, one of
10 the prior art references, teaches that lithium
11 iron phosphate improves the battery output at low
12 state of charge so that is why it is actually
13 added into layers in Saka, so that is a reason.

14 Q How would a POSITA choose NMC over lithium
15 iron phosphate?

16 MS. KELLY: Object to form.

17 A Again, it is my understanding that the NCM
18 is a higher capacity active material, so you are
19 going to get a higher energy density potentially
20 using it.

21 Q Which material is the best material to use
22 as an active material for a cathode in a lithium

1 iron -- lithium-ion secondary battery?

2 MS. KELLY: Object to form.

3 A Well, again, it depends on what you are
4 trying to achieve.

5 So, you know, asking what is the best is a
6 little bit of a trickier loaded question.
7 Certainly, you know, the NCM is used extensively
8 because of its high capacity, but not exclusively
9 and other materials are used. They add other
10 properties, for instance, as we discussed with the
11 LFP.

12 Q What goals do battery designers have in
13 mind when designing battery cathodes?

14 A Well, if you want to do things like, for
15 instance, increase battery safety particularly
16 with regard to things like short-circuits or in
17 fact, problems with overcharging, you want to
18 improve rate performance. And you might want to
19 do all of those things while not compromising the
20 energy density of the battery at least too much.

21 Q Some of those goals do conflict with each,
22 correct?

1 A Yeah. Well, as -- as in any design
2 problem of anything, there is usually tradeoffs.

3 Q For example, a higher discharge rate at a
4 higher charge rate may result in lower safety,
5 correct?

6 MS. KELLY: Object to form.

7 A Potentially, yes.

8 Q It might create higher operating
9 temperatures for the battery?

10 A Potentially, yes.

11 Q And that could increase the risk of
12 thermal runaway?

13 A It could.

14 Q Whereas, lower porosity might result in
15 lower operating temperatures, but slower rate
16 performance, correct?

17 A Potentially, yes.

18 Q Does the intended application for a
19 battery impact a battery designer's goals for the
20 battery?

21 A Yes.

22 Q For example, a battery intended for use in

1 an implanted pacemaker may have different design
2 goals than a cathode for use in a lawnmower or an
3 electric car, fair?

4 A Yes, fair.

5 Q So a battery that is intended for high
6 discharge rates, would not be subject to the same
7 design constraints as a battery intended for low
8 discharge rates?

9 A Hold on a second. I -- I -- I hate to say
10 this, but you kind of glitched a little bit there.
11 I hope I'm not --

12 Q No problem, I will say it again.

13 A -- having problems again -- problems
14 again. I -- I -- I'm here at home, and again,
15 there is -- can you -- can you just repeat that?

16 Q No, I will just reask the question.

17 So a battery intended for high discharge
18 rates would not be subject to the same design
19 constraints as a battery intended for low
20 discharge rates, correct?

21 A Certainly the tradeoffs would be
22 potentially adjusted differently, yes.

1 Q And a battery that is intended for use in
2 a very small device would not be subject to the
3 same design constraints as a battery intended for
4 use in a larger device, correct?

5 A Well, again, different design choices
6 amongst those tradeoffs would likely be made.

7 Q Why would a battery designer want to use a
8 cathode that has uniform structure between the
9 current collector and the separator?

10 MS. KELLY: Object to form.

11 A Well, I think one reason would just be
12 simplicity and economy of -- of making the device.
13 If you are going to go to one of these multilayer
14 structures, it is just a lot more -- it is more
15 expensive and more complicated to make, but you
16 might want to do it to achieve certain
17 characteristics that, you know, are discussed in
18 the various art at issue here.

19 Q Does cathode thickness affect or influence
20 how the cathode is designed?

21 A Yes.

22 Q Why would a battery designer, you know, as

1 of the time of the alleged invention of the '118
2 patent, why would a battery designer use a thin
3 cathode?

4 A Well, probably, you know, things like
5 space requirements. A thicker cathode will give
6 you more capacity, but yeah, making it thinner
7 will also help with the transport issues that --
8 for which you might also increase porosity, right.
9 So it may help with rate performance as well.

10 Q Does the density of a cathode impact how
11 thick it can be?

12 A Yeah, to a certain degree. If it is too
13 thick and it is too dense you have problems
14 getting the electrolyte and lithium ions in and
15 out of it.

16 Q How thick or dense is too thick or too
17 dense?

18 MS. KELLY: Object to form.

19 A I couldn't really say off the top of my
20 head. I haven't really -- I haven't really
21 thought about that. I think some of the art may,
22 you know, at issue here may -- may discuss that,

1 but I haven't really thought about it.

2 Q Porosity impacts density, correct?

3 A It does.

4 Q And that is an inverse relationship?

5 A Yes.

6 Q Higher porosity leads to lower density and
7 vice versa?

8 A Correct.

9 Q Does particle surface area impact density?

10 A To the extent -- you are talking about
11 like specific surface area or like surface area
12 per unit volume of the powder, for instance, or
13 something like that?

14 Q I am thinking of shapes of the particles,
15 right, different --

16 A Okay.

17 Q -- different shapes of particles. Some
18 shapes have a higher surface area and some shapes
19 have less surface area per volume, correct?

20 A Yes.

21 Q A sphere is the lowest amount of surface
22 area per volume?

1 A Yes.

2 Q And the larger the sphere the truer that
3 is?

4 A Well, I mean, when you -- when you had
5 asked your initial question, I was thinking more
6 in terms of particle sizes. So if you make the
7 particle smaller, the specific surface area, the
8 amount of surface per volume gets bigger. But
9 also if you change the shape, if you make plates,
10 for instance, or needles, those are going to have
11 more surface area per volume.

12 Q And do those shapes or sizes impact
13 density?

14 A They can. I mean, that is -- that is one
15 factor. It is not solely determining, but it
16 certainly influences how the particles can and do
17 pack.

18 Q If you achieve a certain compaction
19 density with one set of particles that have
20 specific sizes and specific shapes are you certain
21 to be able to get the same compaction density
22 using different particles with different sizes and

1 different shapes?

2 A I mean, again -- well, these are
3 tradeoffs. So certainly if the particles pack
4 differently, you know, you may need to adjust
5 something else to compensate for that to achieve
6 similar densities, right. So you might have to
7 compact more or use more binder, less binder, you
8 know. These are all different design choices.

9 Q You discuss in your declaration kind of
10 maximum theoretical densities of cathode layers.
11 Do you recall doing that exercise?

12 A I believe I discuss that -- at least,
13 again, with regard to Saka. I may have in other
14 places but certainly -- well -- well, no, actually
15 now that I think about it I also discuss that with
16 Ishigaki.

17 Q And you're referring to the discussion
18 that begins at paragraph 194 on PDF page 100 of
19 Exhibit 1010?

20 A Well, PDF page 100. Well, I mean this is
21 referring to if I -- if I'm looking at what you
22 are indicating, this is referring to claim 19.

1 And I think I did this multiple times, probably
2 starting with claim 1. So -- so yeah, I mean, I
3 think -- I think I probably discussed -- yeah, I
4 discussed it here on page 100, PDF page 100,
5 paragraph 194, but I think that is not the first
6 place I do that.

7 Q Sure, we can go to PDF page 54.

8 A Yes.

9 Q You calculate a maximum theoretical
10 density of the Ishigaki cathode layers?

11 A Yes, yes.

12 Q And that maximum theoretical density is
13 the density when there is zero porosity, correct?

14 A Yes.

15 Q And we all agree, I think, that zero
16 porosity is never an intended compaction
17 density --

18 A Yes.

19 Q -- correct?

20 And you said earlier that one would want
21 at least 10 percent porosity, correct, if not
22 more?

1 A Yeah, I think I said that.

2 Q And so at 10 percent porosity, your
3 theoretical upper limit would be a little less
4 than 4 grams per cubic centimeter, correct?

5 A Well, again, I would have to do that
6 calculation. But yeah, I mean 10 percent of 4.4
7 is about 4 -- so it was about .4. So yeah,
8 that -- that would seem to be the case.

9 Q Yeah, that was the only math I was doing,
10 right. It would be about, you know, 3.96 grams
11 per cubic centimeter?

12 A Yeah. Again, I'm not that good with
13 numbers, but -- which seems -- which seems an odd
14 thing to say for a scientist, but I didn't excel
15 in math in school until they took the numbers out
16 of it and started using letters, then I was good.
17 But anyway, go ahead.

18 Q No, I hear you. I'm a physicist, so I
19 hear you.

20 Do you have any basis to support your
21 opinion that 10 percent porosity would be
22 sufficient porosity?

1 A I am just basing that on values that, you
2 know, that I have seen. Certainly higher values
3 are common as, you know, which you -- you said.
4 I'm -- I can't -- I can't quote something as I sit
5 here today.

6 Q Just to be clear when you say "higher
7 values," you mean higher porosity values?

8 A Yeah.

9 Q Do you know what the typical porosity in a
10 lithium-ion battery would have been at the time of
11 the invention of the '118 patent?

12 A It would probably be at least about 20
13 percent.

14 Q And with --

15 A I think -- I think I calculated one of the
16 Saka layers as 19 percent, but, you know, that is
17 about 20 percent.

18 Q At 20 percent -- 20 percent porosity your
19 maximum density of the Ishigaki cathode layers
20 would reduce to about 3.52? And feel free to
21 pullout the calculator application on your
22 computer if you need to.

1 A I'm using my phone.

2 Q That is fine. The calculation is 4.4
3 times .8, right?

4 A Yes, 3.52.

5 Q And so that would be the maximum density
6 possible of the Ishigaki cathode layers if
7 porosity were 20 percent, correct?

8 A That's what -- that is what you would get
9 at 20 percent porosity.

10 Q Have you seen batteries with 30 percent
11 porosity?

12 A Yes.

13 Q Two cathodes that have the same active
14 material and the same additives would have
15 different densities if the percentages of those
16 materials differ, correct?

17 A Go through that again. I'm not -- I'm not
18 sure --

19 Q Sure.

20 A -- what you are -- what you are getting at
21 here. So yeah, let's go through it again.

22 Q Yeah, I will reask it.

1 So if you have two different cathodes that
2 use the same materials, that is, the same active
3 material, the same additives, the same polymers
4 but they use different ratios of those materials,
5 those cathodes would have different densities,
6 correct?

7 A Well, they could unless you adjusted
8 something else, for instance, the porosity.

9 Q Sure. But you would typically expect them
10 to be different rather than two --

11 A I hate to say this, but you're -- you're
12 glitching again.

13 Q I'm sorry.

14 A Let me go and see -- I feel really bad --

15 Q No worries.

16 A -- because this happened before and now
17 I'm at home. You know, we can try -- at lunchtime
18 I can go over to my office, which is where we were
19 before, but let me also try and just fiddle with
20 the -- with the Wi-Fi antenna.

21 Q One thing that may work and we can do this
22 at the break is if you joined --

1 A You're -- you're -- you're -- you're
2 glitching.

3 MR. COX: Okay.

4 COURT REPORTER: Do you want to go off the
5 record?

6 MR. COX: Let's go off the record for now.

7 (Recess, 1:16 to 1:24 a.m.)

8 Q So I was asking you a question about two
9 different cathode materials that use, sorry, two
10 different cathodes that use the same materials but
11 use those materials in different ratios. Do you
12 recall that line of questioning?

13 A I do.

14 Q You would typically expect two cathodes
15 absent coincidence to have different densities
16 rather than the same density, correct?

17 MS. KELLY: Object to form.

18 A I'm not sure what "coincidence" means.
19 You know, I think that -- again, you could -- you
20 could certainly probably make them have the same
21 density if you adjust something else like
22 porosity.

1 Q But if you maintain the same porosity but
2 instead lowered the ratio of active material, you
3 would typically expect the densities to be
4 different, correct?

5 A Yeah. I mean, I'm thinking of some things
6 that might happen, but what would -- the mechanism
7 would decrease the porosity, so yes.

8 Q Once you have achieved a maximum
9 theoretical density, what happens if you tried to
10 compact the layer further?

11 A Well, I mean these things are pretty much
12 incompressible. So I mean, you can't unless you
13 go to, you know, extreme pressures which are going
14 to cause the thing to sort of squeeze, you know,
15 and break and, you know, squish out the sides and
16 all kinds of stuff.

17 Q Those kinds of stuff are undesirable
18 outcomes, fair to say?

19 A Yes.

20 Q Using high compaction pressure can result
21 in undesirable fracturing and other problems with
22 the cathode, correct?

1 A It could, yes.

2 Q Do you know what pressures are typically
3 used for the calendaring process?

4 A No, not off the top of my head.

5 Q Do you know any of the ranges of pressures
6 that are typically used?

7 A No, not off the top of my head.

8 Q Do you know if different compaction
9 pressures are used for different types of cathodes
10 or different active materials?

11 A I believe they are, because again, you
12 want to adjust the density or the porosity so you
13 would use different pressures.

14 Q Do you know what the maximum -- sorry.

15 Do you know what the minimum porosity you
16 can achieve through the calendaring process is?

17 A I don't know that off the top of my head.
18 I would suspect that it might be above zero.

19 Q What is the difference between a one-layer
20 cathode structure and a two-layer cathode
21 structure?

22 MS. KELLY: Object to form.

1 A Well, I mean, one of them has one layer
2 and one of them has two layers.

3 Q Is every layer inherently comprised of two
4 layers or more?

5 A What do you mean is every layer inherently
6 -- every -- in batteries in general or --

7 Q Yeah, in a cathode?

8 A What are you talking about?

9 Q Yeah, so in a cathode layer if I'm looking
10 at a cross-section of a active material layer, for
11 example, how I do know from that cross-section if
12 there is one layer or two layers?

13 A Well, you may be able to see a -- like, if
14 you are looking at it in, say, a scanning electron
15 microscope, an SEM image, you may see a little
16 line where there was actually like a little
17 interface, and, you know, maybe some kind of skin
18 formed where there was a little bit more binder on
19 the surface. And then -- so there will be some
20 sort of structural difference like that.

21 Or it could be that there is difference in
22 the particle size, there is a difference in the

1 particle loading, there is a difference in the
2 porosity. You know, there is -- the layers will
3 look different in, say, scanning electron
4 microscopy in a cross-section.

5 And again, there might somebody sort of an
6 interface that -- that is visible.

7 Q What -- what if there is no interface and
8 there is no difference in the particles or types
9 of particles between the top and the bottom of the
10 layer, does that mean it is a single layer?

11 A Well, you asked this question before.
12 This is -- you know, when you put on two layers of
13 paint is that a single layer or a double layer.

14 I think that it would be a double layer
15 because of how it is made, at the very least. And
16 there may be other structural, say, not be visible
17 in the SEM experiment, but there still might be
18 differences such as different densities or
19 different porosities.

20 Q Claim 1 of the '118 patent is an apparatus
21 claim, correct?

22 A Yes.

1 Q And in fact, all of the claims of the '118
2 patent are apparatus claims, correct?

3 A I believe so.

4 Q And feel free to look at Exhibit 1004 if
5 you want.

6 A Yeah, that is my recollection, because
7 I -- you know, I looked at that, sure.

8 Q Do you know the difference between an
9 apparatus claim and a method claim?

10 A Well, again, I think we discussed some
11 other -- what were we talking about, I forget. We
12 were talking about some other legal principle. I
13 do, I think, to the degree that a POSA would
14 understand it or somebody who -- a POSA like
15 myself that has had the good or bad fortune to be
16 involved in legal matters so I suppose I do, yeah.

17 Q Nothing in the apparatus claim requires
18 the second layer to be applied at a different
19 time, correct?

20 A The apparatus claim doesn't say anything
21 about how anything is constructed. It doesn't
22 claim anything about how a claim is constructed.

1 Q It only claims the specific arrangement in
2 the electrode or the electronic device, correct?

3 A It does.

4 Q And so in the instance where the claimed
5 second material is the same material as the
6 claimed first material, how do you have a second
7 layer?

8 A Again --

9 MS. KELLY: Objection, form.

10 A You know, when you say, "the same
11 material," which characteristics are the same?

12 Q I'm going to say all of them for purposes
13 of my question.

14 A Right. And you are saying that, you know,
15 there is no sort of skinning process that happened
16 when the first layer was formed that generates
17 some kind of a line or interface that you can see?

18 Q Sure.

19 A Well, yeah, I don't know how you would
20 tell.

21 Q So if you can't identify any dividing line
22 between layers because the first and second

1 material are identical and there is no interface
2 defining a boundary between the two, that would
3 mean the cathode has one layer not two, correct?

4 MS. KELLY: Object to form.

5 A Yes, in some sense of looking at the
6 situation that would be an interpretation.

7 Q Would you go to PDF page 48 of your
8 declaration, Exhibit 1010?

9 A 48.

10 MS. KELLY: What paragraph?

11 Q Paragraph 73, but continuing on to the
12 next page.

13 A Okay.

14 Q Do you see -- do you see you have prepared
15 a number of demonstratives? I'm looking at Gido
16 demonstrative 1.

17 A Yes.

18 Q These are meant to be illustrative or
19 exemplary only not to scale diagrams, correct?

20 A Yeah, they -- they certainly are not to
21 scale.

22 Q And you have drawn here a black line

1 between the first positive electrode mixture layer
2 and the second positive electrode mixture layer,
3 correct?

4 A Yes.

5 Q In the real world in practice and in the
6 prior art, there is no actual such line defining
7 the boundary, right?

8 A Again, unless there is some kind of
9 surface process due to migration of the binder to
10 the surface or the contact with the role during
11 the calendaring of the first layer, that could
12 create some kind of a thing that would show up as
13 a line in some kind of imaging process, but
14 certainly nobody draws a line like I drew in that
15 diagram.

16 Q If what you have defined here as the
17 electrode mixture, the first and second layers, is
18 uniform between the current collector and the
19 separator, that would be an example of a single
20 layer structure, right?

21 MS. KELLY: Object to form.

22 A So you're saying that if, for instance,

1 the smaller particles on the bottom or the larger
2 particles on the top if you took one of those and
3 you just made the whole thing that, that is what
4 you are saying?

5 Q Either that or if both of these were
6 evenly intermixed with each other, either one?

7 A Right. Yeah, I mean that would -- that
8 would appear to be a single layer.

9 Q What is desirable or attractive about a
10 single layer structure?

11 MS. KELLY: Object to form.

12 A I think you asked me that question before
13 and, you know, the answer is the same, is that it
14 is -- it is simple. It is easier to make, more
15 economical.

16 Q Are there any instances where the boundary
17 between the first layer and the second layer
18 creates any kind of structural risk for the
19 battery?

20 A Potentially.

21 Q For example, you might have the same type
22 of adhesion between the first and second layer?

1 A Yeah, yes. If -- if the second layer
2 doesn't sort of wet well or adhere well to the
3 underlying layer, that would certainly be a
4 problem.

5 Q When you compact the layers, what happens
6 at the interface or the boundary between the first
7 and second layer?

8 A Well, to the extent that compaction shifts
9 the positions of particles and changes the pore
10 structure and so forth, that can potentially
11 happen across that boundary.

12 Q When compaction occurs of the first and
13 second layer, will you necessarily have the same
14 density in the first layer as you do in the second
15 layer?

16 MS. KELLY: Object to form.

17 A So you are talking about a case where
18 these two layers were put down and neither one of
19 them was compacted first and then you compact the
20 two of them together? Is that what you are asking
21 about?

22 Q Not necessarily. You could -- you could

1 compact the first layer and then add the second
2 layer and compact it or you could just apply both
3 layers and then apply one compaction step. I
4 think my question is the same.

5 What happens when you compact the two
6 layers? Are you going to have the same compaction
7 density across both layers?

8 MS. KELLY: Object to form.

9 A Not necessarily, um...

10 Q Did you have something to add after the
11 "um" or was that --

12 A Well, I mean, you know, I'm -- I'm -- I'm
13 answering your question. If you want to ask a
14 follow-up question I could elaborate, but I'm
15 answering the question you asked.

16 Q Sure. I just didn't want to cut you off
17 if you had an additional answer.

18 My follow-up is the different layers may
19 have different compressibilities, correct?

20 A Yes, I mean, the two layers will
21 experience the same stress, right, they're in
22 series. And they will both experience the same

1 stress, but their response to that stress may be
2 different. They may -- they may have different
3 compressibilities for various reasons.

4 Q And I'm going to pushback just a little
5 bit on experiencing the same stress, right,
6 because some of those forces, those downward
7 compression forces, may be absorbed or deflected
8 in different directions in the second layer. And
9 those forces might not make it all the way to the
10 first layer, correct?

11 A I mean, the force is the force. There
12 is -- there is a force that is being applied.
13 Yeah, I suppose things could shift and relieve
14 some stress in one layer and prevent the
15 transmission to the next to some degree. But
16 pretty much you're compressing these things in
17 series, so they're experiencing a similar force or
18 stress, but they may respond differently because
19 of differences in their structure.

20 Q Right, by analogy, and I promise my
21 analogy only, if the first layer is -- is a pile
22 of ball bearings and the top layer is a layer of

1 mini marshmallows, the top layer may experience
2 more compression than the -- than the first layer,
3 correct?

4 A Yes.

5 Q Because those forces and stresses may be
6 absorbed differently across the different layers
7 depending on their composition and materials?

8 A Right. I mean, yes, I suppose. I mean, I
9 wouldn't say absorbed. I would say that the
10 responses of the two materials that -- the strain
11 response of the two materials is dramatically
12 different, but that may be -- that may be the same
13 thing, you know.

14 Q You may have just said it more
15 scientifically, I think.

16 A Yes. That is what -- that was what I was
17 going to follow-up with, but -- but, yes; similar
18 concept though.

19 Q If one layer is at a maximum possible
20 density but the other layer is not, then the
21 entire composition won't be at the maximum
22 possible density, right?

1 A Yes.

2 Q Could you describe the difference between
3 a primary particle and a secondary particle in the
4 context of the '118 patent?

5 A I can. And you know, I think it might be
6 useful in this declaration to go -- I think I show
7 these -- discuss this and also show this several
8 times at least.

9 So I am now at paragraph 108 on page 64
10 and I don't know whether that is the first time I
11 show this or not. It -- it could be. But so at
12 least in the -- in the case of the NCM material,
13 the particles have primary particles which are
14 smaller and those aggregators stick together to
15 form larger secondary particles as shown in these
16 scanning electron microscope images.

17 Q In forming laser diffraction, do these
18 larger particles become deagglomerated?

19 A No, they do not.

20 Q Ever?

21 A Well, I mean, it depends on, you know, if
22 you do something to try and further pulverize or

1 smash them or whatever, you know, they could to
2 some degree. I don't believe you could ever get
3 down to a distribution of primary particles. They
4 would also -- they would constantly be trying to
5 find one another and reaggregate anyway. But
6 certainly -- certainly you might change it
7 depending on how you -- how you prepared the --
8 the solution.

9 Q Do you understand that in laser
10 diffraction these particles are put in motion?

11 A Yes.

12 Q And that is using compressed air --

13 A Often, yes.

14 Q -- or some compressed gas rather?

15 A Oftentimes, yes.

16 Q And do you believe that those samples do
17 not deagglomerate or breakdown into smaller-sized
18 particles as the particles collide with each other
19 or with the wall of the unit?

20 A If you are operating it appropriately, you
21 would certainly want to minimize that. I mean,
22 the whole point of doing this test is to measure

1 size. And if the test changes the size, you know,
2 that is sort of a problem. You're a physicist, so
3 it is kind of like the Heisenberg Uncertainty
4 Principle of Particles. You don't want your test
5 to change the result.

6 Q Got it. With that I think we're about to
7 your lunch break. Are we okay to go off the
8 record?

9 A I think that is fine.

10 MS. KELLY: Okay.

11 (Recess, 12:49 to 1:21 p.m.)

12 Q Dr. Gido, did you speak with your counsel
13 over the lunch break?

14 A I did not.

15 Q I will ask you if you do discuss anything
16 with your counsel at any break that you please let
17 me know that you had a discussion?

18 A Of course.

19 Q Do primary particles have pores?

20 A Primary particles. To the extent that the
21 structure is not kind of a, you know, perfect
22 crystallographic plane, you know, there may be

1 some irregularity in, you know, in the particle
2 that -- that constitutes some kind of microscale
3 porosity.

4 Q Do secondary particles have pores?

5 A Well, I mean as you can see there, if
6 we're still looking at the SEM images at 108.

7 Q Sure.

8 A They -- you know, they do. Well, I guess,
9 let's back up a little bit here.

10 I'm not -- when you talk about primary
11 particles having pores and secondary particles
12 having pores, are you talking about the particle
13 itself or are you talking about a, you know,
14 packing or a sample of the powder?

15 Q I am talking about the particle itself, so
16 I think your answers were in line with my
17 question.

18 A Okay, yeah. So then, yes. There --
19 there -- there could be some porosity. It is, you
20 know, there is some evidence of that in, in at
21 least in the surface of the secondary particles.

22 Q The existence of that porosity would

1 further decrease the maximum achievable compaction
2 density, correct?

3 A Yes, potentially.

4 Q Do you measure the size of the secondary
5 particles using the laser diffraction or other
6 comparable methods that we discussed earlier?

7 A Well, you said -- I -- I didn't in this
8 particular case, but -- but people do certainly.

9 Q Yeah, I mean does one?

10 A Yes, one does.

11 Q How does one measure the size of a primary
12 particle, the part of a secondary particle?

13 A Right. Well, at least in -- for instance,
14 in Ishigaki and in -- in, you know, other -- other
15 art, there is a problem that you can't -- that
16 those primary particles are not dispersed. So you
17 can't use the diffraction method, you need to do
18 something else. And one thing that can be done is
19 image analysis with electron microscope images.

20 Q Could you also do dispersion of the
21 particles?

22 A I think that it would be difficult to try

1 and pulverize those secondary particles down to,
2 you know, making sure that you're -- you have, you
3 know, just primary particles and trying to do some
4 kind of a, you know, some -- some kind of a
5 scattering or diffraction experiment on that.
6 Typically -- typically this kind of image analysis
7 is done instead.

8 Q What considerations would a battery
9 designer have when choosing a binder for a
10 cathode?

11 A Well, you want electrochemical stability,
12 you want certain thermal properties, right. You
13 know, you -- you don't want it to -- you want it
14 to have basically a relatively high melting point
15 so that it doesn't flow if the battery gets a
16 little bit warm.

17 So you want properties associated with its
18 wettability, its -- its ability -- surface energy
19 for interactions with the active material and also
20 with the current collector plates, so it needs to
21 adhere.

22 So yeah, well, I mean, those are -- those

1 are some properties that certainly one would
2 consider.

3 Q Is a high melting point at odds with any
4 other desired qualities or characteristics of a
5 binder?

6 A Well, I mean, it -- it -- you don't want
7 the melting point to be super high, right. And,
8 you know, I think it would -- it could potentially
9 have problems for processing and it would
10 certainly make the material perhaps too stiff and
11 rigid to be used, for instance.

12 In compaction, things that are -- a lot of
13 materials that are very high melting points are
14 very, very rigid materials, so there could be
15 problems with sort of ductility and compaction and
16 so forth.

17 Q Why would a battery designer use small
18 active material particles as compared to large
19 active material particles?

20 A Well, a couple of reasons. One, the
21 smaller particles could potentially pack more
22 densely especially if you know they're part of a

1 distribution where the smaller ones can go in
2 between the bigger ones and -- but you want to
3 make sure that that small end of the distribution
4 was populated enough, for instance, to fill those
5 interstices that could allow you to get higher
6 packing densities if that is what you want.

7 And also a better exchange of the lithium
8 with the electrolyte, which has to happen at the
9 surface or through the surface.

10 Q Why would a battery designer use large
11 active material particles as compared to small
12 active material particles?

13 A Well, it could, for instance, allow you to
14 tailor the porosity, it could allow you to
15 influence the mechanical properties. It would
16 make a stronger layer, for instance.

17 Q Is it typically true that the active
18 material is a stronger material than binder?

19 A Generally, yes.

20 Q Why would a battery designer use a range
21 of particle sizes instead of using a uniform
22 particle size in an active material layer?

1 A Well, there really is no such thing as a
2 uniform particle size. There is always a range,
3 because these are made by some kind of a, you
4 know, random processes of both, you know, crystal
5 growth followed by pulverization or grinding. And
6 these all lead to a distribution, so you always
7 have a distribution.

8 And but the breadth of that distribution,
9 again, influences things like packing. If you
10 have a broader distribution, or if, for instance,
11 you have a bimodal distribution, you can have
12 smaller particles fitting into the interstices of
13 the packing of bigger particles.

14 Q So smaller particles can plug the gaps or
15 the pores between larger particles which would
16 lead to higher density, but it would also create
17 greater difficulty for ion flow across the
18 electrode?

19 A That would be a -- I mean, you know,
20 they're not going to plug it completely.

21 Q Sure.

22 A It is just going to be another feature of

1 controlling porosity in the ion flow. When I say
2 bimodal, it is not two sizes. It is a
3 distribution basically of all sizes. It just
4 happens to have two peaks.

5 Q Understood. Fair to say that the particle
6 size distribution influences the achievable or
7 desirable compaction density?

8 MS. KELLY: Object to form.

9 A Well, it certainly influences it. You
10 know, amongst other ingredients and other factors,
11 but it certainly is a -- is a factor.

12 Q Could you please turn to paragraph 85 of
13 Exhibit 1010?

14 A Paragraph 85?

15 Q That's right. So that is -- I will tell
16 you the page in a second. We discussed it
17 earlier. It is on PDF page 54.

18 A Okay.

19 Q Your -- your calculation of the maximum
20 theoretical density of Ishigaki, that -- that is
21 the result of your own calculations. That is not
22 taught or described in Ishigaki itself, correct?

1 A I believe that is the case. Again, you
2 know, it has been a year or so since I did this,
3 and I haven't looked through Ishigaki to make sure
4 that that is true, but it is my recollection that
5 this was something that I calculated.

6 Q Ishigaki nowhere talks about a compaction
7 density of 4.4 grams per cubic centimeter,
8 correct, and that is in Exhibit 1004?

9 A Yeah. Well, I just did a search for 4.4
10 in Ishigaki, and I got 4.4 volts a couple of times
11 but I did not get that particular density.

12 I don't -- it is my recollection, and
13 again, I could be wrong, but it is my recollection
14 that Ishigaki did not -- did not report a
15 theoretical upper limit.

16 Q Ishigaki teaches particular densities for
17 the bulk density of the second positive electrode
18 active material, correct?

19 A Say that again.

20 Q Ishigaki teaches particular densities for
21 the bulk density of the second positive electrode
22 active material, correct?

1 A Could be, yes, yes.

2 Q I'm looking at PDF page 46 of Exhibit
3 1004.

4 A Okay, all right. I'm -- I'm doing a
5 search on bulk density. I'm seeing it mentioned
6 in the section where they talk about BET surface
7 area. But then bulk density, I mean, I'm finding
8 something on page 19, PDF page 19. The bulk
9 density of the lithium transition metal compound
10 powder. So yeah -- yes, it is -- it is in here.
11 And if I recall correctly, you know, this -- this
12 discussion is probably in here a couple of times.

13 Q If you look at page -- PDF page 46 of
14 Exhibit 1004 at paragraph 181, do you see where it
15 talks about the normal and preferable densities
16 for the second positive electrode active material?

17 A This is page 181?

18 Q No, paragraph 181, so PDF --

19 A I mean, sorry, yeah, paragraph 181. Yes,
20 I see that.

21 Q Do you see that the most preferable bulk
22 densities are defined as being between 2.4 and 2.7

1 grams per cubic centimeter?

2 A Yes, yes. When you look at that range,
3 yes.

4 Q And Ishigaki cautions that bulk densities
5 exceeding that upper limit may result in an
6 excessively low specific surface area, which may
7 result in reduced battery performance. Do you see
8 that?

9 MS. KELLY: Object to form.

10 A I see that it says that.

11 Q And Ishigaki also teaches when the bulk
12 density falls below the lower limit of 2.1, there
13 is a possibility of the powder packing properties
14 and electrode preparation being adversely
15 affected?

16 MS. KELLY: Object to form.

17 A I see -- yeah, I see that.

18 Q Do you have any reason to dispute
19 Ishigaki's teachings about those desirable
20 densities?

21 MS. KELLY: Object to form.

22 A Well, yeah. I mean, that is what Ishigaki

1 says. So that is what -- what Ishigaki is
2 teaching for its invention.

3 Q Are you familiar with tap density?

4 A Yes.

5 Q What is tap density?

6 A It is a kind of density measurement, which
7 sometimes might be called bulk density, where you
8 take a powder and you put a certain volume of it
9 typically like in a graduated cylinder. And you
10 tap it a certain number of times, which causes the
11 particles to kind of jostle around and settle, and
12 then you measure a volume.

13 Q Your calculation of Ishigaki's maximum
14 density is a calculation for a single cathode
15 layer, correct?

16 A It is a calculation that would apply -- I
17 applied it to the combination of the two layers.
18 That is why I -- that is what I was doing it for.

19 Q Would each layer have the same maximum
20 compaction density?

21 A Yes. So basically if you are looking at a
22 combination of two layers, each having a separate

1 density, as the density gets higher and higher,
2 they have to converge -- well, if the compositions
3 are the same, right, then they would have to
4 converge to the same thing at zero porosity at the
5 maximum density.

6 Q Now, if the compositions are the same --
7 withdraw that.

8 But if the compositions are different, the
9 maximum compaction density would be at least
10 slightly lower than your calculated maximum
11 compaction density for a uniform layer, correct?

12 A If the compositions were different. I
13 think it says somewhere in my report where I
14 discuss this, let's see.

15 Maybe paragraph 90 where -- I actually did
16 two different -- two different compositions, but
17 they both came out to the same 4.4 to within two
18 significant figures, right.

19 So the composition information that is
20 given in Ishigaki is only to, you know, one or two
21 significant figures. And so it doesn't really
22 make sense to try and split it any finer than

1 that. But certainly if you had more significant
2 figures and carried those through the calculation,
3 those two numbers would not be exactly the same.

4 Q One would be higher than the other?

5 A Well, of course, because you have got two
6 numbers that aren't different so -- or that are a
7 little bit different, so one is inherently higher
8 than the other.

9 Q Paragraph 24 of Ishigaki talks about the
10 process.

11 A What 24, paragraph 24?

12 Q Sorry, paragraph 24. Let me tell you what
13 page that is, PDF page 11.

14 A Where is this?

15 Q Paragraph 24, the bottom of PDF page 11.

16 A Wait a minute, I'm getting a little
17 confused.

18 Q Of Exhibit 1004?

19 A Right, paragraph 24?

20 Q That's right, near the bottom.

21 A Yeah.

22 Q Do you see where it discusses that the

1 positive electrode active material layer obtained
2 by coating and drawing is preferably compressed by
3 a hand press or a roller press or the like in
4 order to increase the packing density of the
5 positive electrode active material?

6 A That is what it says.

7 Q This paragraph is only discussing one
8 layer, correct?

9 A I don't know what it is discussing. We
10 would have to -- I would have to look. I mean,
11 so -- so I mean, Ishigaki is organized in such a
12 way that it basically says at the beginning, that
13 this could be one layer or it could be two layers.
14 And then it discusses a whole bunch of
15 characteristics which sound like one layer, but
16 then further on down it says and basically we
17 could put the second layer on top of this, in
18 which case the one layer now becomes the first
19 layer.

20 And so -- so yeah, I think -- I think -- I
21 don't think there is anyplace in Ishigaki where
22 any of these specifications apply specifically

1 only to one layer.

2 Q Does paragraph 24 or does paragraph 25
3 discuss multiple layers?

4 A It is talking about a layer.

5 Q If we go to paragraph 151 of Ishigaki and
6 that is at PDF page 39.

7 A 151?

8 Q Yes.

9 A Okay.

10 Q And you see that this paragraph is, at
11 least by the translation, broken up into four
12 paragraphs of its own?

13 A Yes.

14 Q And the third paragraph of paragraph 151
15 as well as the first both discuss a positive
16 electrode active material layer, correct?

17 A That's what it says.

18 Q And they only discuss one layer in this
19 paragraph, correct?

20 A Yes. And well in reading this, when I
21 read it and also a POSA when they would read it,
22 would understand that this is either a single

1 layer or it is the first layer of two layers,
2 because further on down they put the second layer
3 on, so either.

4 Q Paragraph 153 describes that the second
5 positive electrode mixture layer contains a second
6 positive electrode active material whose particle
7 diameter is larger than that of the first positive
8 electrode active material, correct?

9 A That is my recollection, although I would
10 like to -- lets see -- see -- second, yeah, whose
11 particle is larger, yes, that is what it says.

12 Q These different compositions would have
13 different densities, right?

14 A Not necessarily. I mean, we discussed at
15 some length how there are many factors that
16 influence this, but they're all adjustable. So
17 you could make the particles bigger, but then you
18 might do something else to, you know, compensate
19 for that.

20 Q You said earlier that porosities of less
21 than 10 percent would be undesirable in a
22 lithium-ion battery, correct?

1 A I don't know whether I used the word
2 undesirable. I think I just said that I have
3 really not seen that.

4 Q You prepared some demonstratives in your
5 declaration that contain yellow and red coloring.

6 A I did?

7 Q Demonstratives 7 and 8 on PDF 59 of
8 Exhibit 1010?

9 A Yes.

10 Q Could you describe how you created these
11 demonstratives?

12 A Yes. So Ishigaki teaches density --
13 densities or a range of densities for a two-layer
14 system, actually for a single-layer system or a
15 two-layer system.

16 And in the case where it is a two-layer
17 system that value, a POSA would understand, would
18 refer to the average density averaged over both
19 layers. And the broadest teaching that Ishigaki
20 has is that the -- that the density is greater
21 than 2.0 grams per CC.

22 And we discussed a calculation of the

1 maximum density and the -- the colored region,
2 yellow and red, in for instance Gido demonstrative
3 7 -- actually in both of them, is just the
4 combinations of layer densities of layer 1 and 2
5 that average out to be -- well, each -- each
6 combination averages out to a kind of a linear
7 relationship of the diagonal lines, right.

8 So for instance, if you were to pick a
9 density of, say, 3.2 grams per CC, then there is a
10 diagonal line there that are all the individual
11 layer density values of combinations of layer
12 density value 1 and layer density value 2 that add
13 up to 3.2, right.

14 So you know, you move around on this
15 diagram between the two layer densities on these
16 diagonal lines, which I've labeled. But then --
17 and, of course, there is, you know, more of those
18 diagonal lines. I've just shown sort of exemplary
19 ones for specific kind of round -- round density
20 values, but there is, you know, basically an
21 infinite set of these diagonal lines.

22 And basically what is shown there is that

1 all of the colored region is overall densities
2 taught by Ishigaki. And so all the combinations
3 in the colored regions are combinations of layer 1
4 and layer 2 that satisfy the teachings of
5 Ishigaki.

6 The ones in red are the ones that are
7 above 3.2 grams per CC, which is the element in
8 claim 1. And there is two graphs there, the top
9 one and the bottom one for two different ratios of
10 thickness of layer 1 to thickness of layer 2,
11 which are taught by Ishigaki.

12 Q You say that the colored regions are all
13 the combinations of layer 1 and layer 2 that
14 satisfy the teachings of Ishigaki?

15 A Well, yes, in that they are above, for
16 instance, 2.0 grams per CC and below, you know,
17 the maximum possible density.

18 Q Ishigaki doesn't teach any densities above
19 4.2 grams per CC, correct?

20 A No. Well, I mean, Ishigaki I think most
21 generally says above 2.0 and doesn't give an upper
22 limit. And I think there is someplace in Ishigaki

1 where they do narrow this somewhat and give some
2 upper values. Let me see.

3 Q Are you referring to PDF page 39 of
4 Ishigaki at paragraph 151?

5 A Yes. In fact, I think I just did a search
6 for 2.6 and it took me right there.

7 Yeah. And I think the 4.2 in my graph --
8 because the 4.2 in my yellow and red figure, the
9 upper value that I gave wasn't 4.4. It wasn't the
10 maximum density with no porosity, the theoretical
11 maximum. It was the upper limit taught by
12 Ishigaki.

13 Q So in your demonstrative 7, fair to say
14 that Ishigaki doesn't teach anything in the
15 rightmost column of the squares that you have
16 identified there?

17 A What do you mean, the rightmost column of
18 squares?

19 Q So you have a layer 1 density of 4.2 to
20 4.4?

21 A Yes.

22 Q Is there any teaching in Ishigaki of a

1 layer 1 density that is above 4.2 grams per CC?

2 A I would say that is unlikely. I mean, I
3 would have to think about that a little bit,
4 because it gets tricky. I think at 151 -- let me
5 go back. I'm trying to go backwards here, let's
6 see.

7 So yes, so 151 is talking about the first
8 layer before you put the second layer on, or it is
9 talking about a single layer. And I'm trying to
10 see whether they say anything about the second
11 layer by itself or whether, you know, 151 would
12 basically apply to both layers. But yeah, I think
13 that is probably a fair thing to say is that, you
14 know, it is unlikely that you would want to have
15 one of the single layers be higher than this 4.2,
16 which Ishigaki says is -- is -- is the -- is the
17 limit.

18 Q And the same is true for the layer 2 not
19 being above 4.2?

20 A Yeah, I would say that is fair.

21 Q Okay. So the kind of rightmost column in
22 the topmost row of values I think you will agree

1 are not taught by Ishigaki?

2 A I would -- I would say that -- that
3 Ishigaki's teachings don't necessarily support
4 that.

5 Q And the white regions of this
6 demonstrative are regions that you agree are not
7 taught by Ishigaki, correct?

8 A You mean like the -- the far lower left
9 corner or far upper right corner?

10 Q That's right.

11 A Yeah. I mean, yes, that is kind of one of
12 the points in the figure, yes.

13 Q Do you see at the upper right diagonal of
14 your demonstrative 7 is where you have indicated a
15 density of 4.2 grams per CC?

16 A Yeah, I see that.

17 Q The only place at which that would occur
18 would be if both layer 1 and layer 2 were the same
19 density of 4.2 grams per CC, correct?

20 A Well, if we are doing what you have
21 contended and removed that upper row in that
22 rightmost column, then yeah, the only place the

1 diagram hits that diagonal line is at a single
2 point.

3 Q Wouldn't that be a single layer if both
4 densities of both layers were the same?

5 A Not necessarily. If the -- for instance,
6 the particle sizes were different or if the
7 compositions were different, because remember I
8 said in doing the calculation even though the
9 compositions of the two example layers that I used
10 were somewhat different, at least the two
11 significant figures they both came out the same.

12 Q Do you know if every combination of layer
13 1 density and layer 2 density that you have
14 depicted on these demonstratives is, in fact,
15 achievable?

16 A I'm not sure. I didn't -- I didn't look
17 into that. This is -- this is just simply a
18 construction based on density ranges taught by
19 Ishigaki.

20 Q Does Ishigaki teach any layer 2 density of
21 less than 2 grams per cubic centimeter?

22 A I don't know. I mean, Ishigaki lists that

1 as a lower bound that the layers should be above
2 either individual -- either a single layer or the
3 average two of layers. I don't know whether there
4 is anywhere in that document that Ishigaki reports
5 anything less than that. I don't recall -- I
6 don't recall seeing that though.

7 Q So do you know if Ishigaki teaches any of
8 the values shown in your demonstrative where the Y
9 axis is below 2.0?

10 A Where the Y axis --

11 Q Yeah. So those lower nearly three rows of
12 this demonstrative?

13 A So that would, again, be in the white
14 region more or less.

15 Q Part of it would be, but I'm also looking,
16 for example --

17 A If you are looking at a little bit of the
18 red way over on the other side?

19 Q Let me try and be clear. So this is an
20 X/Y demonstrative, right?

21 A Yes.

22 Q And the X axis depicts layer 1 density

1 ranging from 2.0 to 4.4, correct?

2 A Yes.

3 Q And the Y axis depicts layer 2 density
4 ranging from 1.2 to 4.4, correct?

5 A Yes.

6 Q Is there any evidence that you are aware
7 of in Ishigaki that it is possible for there to be
8 any layer 2 whose density is less than 2.0 grams
9 per cubic centimeter?

10 A I didn't see any teaching on that. So
11 yeah, I don't -- I don't -- I didn't see --
12 Ishigaki teaches that the density should be
13 greater than 2. So yeah, it could very well be
14 that -- a little bit of that red over on the other
15 side that is below 2 really might not be
16 achievable under the teachings of Ishigaki.

17 Q Do you know if it is possible to achieve a
18 layer 2 density of 2.0 while simultaneously
19 achieving a layer 1 density of 4.2?

20 A I don't -- I don't know off the top of
21 my head. I mean, that would -- that would seem to
22 be something that Ishigaki teaches as a

1 possibility and a POSA could consider. Whether or
2 not they could achieve that, they would have to,
3 you know, do some experimentation.

4 Q Where do you think Ishigaki teaches that
5 it is possible to have a layer 2 density of 2.0
6 while simultaneously achieving a layer 1 density
7 of 4.2?

8 A That is a very, very specific combination
9 and Ishigaki doesn't teach specific combinations,
10 so but that doesn't mean that it is not consistent
11 with what Ishigaki teaches. So, you know, this
12 figure is basically to just show possible
13 combinations of layer 1 and layer 2 that are
14 consistent with the ranges that Ishigaki teaches.

15 Whether or not every single one of them,
16 how you would prepare every single one of them
17 Ishigaki doesn't teach. But that doesn't mean,
18 then, that if Ishigaki doesn't teach any specific
19 one that you know it is not -- if Ishigaki doesn't
20 explicitly talk about how to construct any
21 individual combination in this graph doesn't mean
22 that it is not consistent with Ishigaki's

1 teachings.

2 Q Similarly do you know if it is possible to
3 obtain a layer 1 density of 3.2 and a layer 2
4 density of 4.2?

5 A I don't know, you know, as a practical
6 matter, necessarily how you would do that, but it
7 is consistent with Ishigaki's teaching.

8 Q What happens when you are at the highest
9 extremes of densities for both layers, for
10 example, both layers at or above 4 grams per CC?

11 A What do you mean what happens, with
12 respect to what figure of merit?

13 Q What happens to the resulting overall
14 active layer --

15 A Well, again --

16 Q -- density?

17 A -- what are you talking about? The
18 battery performance or the densities or what are
19 you talking about?

20 Q Let's talk about battery performance?

21 A Well, I mean, as you get higher, for
22 instance, properties like the rate performance are

1 going to go down, but capacity will go up. And
2 you know, for certain applications that might be
3 appropriate, for others it might not be.

4 Q Let's go on to Kim, it is Exhibit 1009.

5 A Okay, hold on. Are there any of these
6 that I can close?

7 Q You can probably close Ishigaki for now,
8 close your CV for now, close your Excel
9 spreadsheet for now.

10 Tell me what else you have open. I've
11 been closing as I go, too.

12 A Let's see, paper number 1.

13 Q Yeah, you can probably close that for now.
14 Of course you can always reopen any of these if
15 I --

16 A Yeah, I know. I'm just trying to reduce
17 the clutter, so it's less difficult for me to find
18 things.

19 Q Sure.

20 A And also at some point Acrobat might start
21 to puke on me.

22 So now the -- you wanted Kim, right?

1 Q That's right, Exhibit 1009.

2 A Okay, 1009, okay.

3 Q Do you recognize this exhibit?

4 A I do.

5 Q This is the Kim reference that you rely
6 upon in your declaration?

7 A It is.

8 Q And what type of battery is depicted in
9 Kim?

10 A You mean a cylindrical cell, you mean?

11 Q That is what I mean, yeah. And it is a
12 lithium-ion battery.

13 A It is a lithium-ion battery that happens
14 to have a winding geometry as a cylinder.

15 Q You rely on the press density of the
16 composite cathode active material that is
17 described in Kim, correct?

18 A Yes, that is what I'm basically using it
19 for.

20 Q And that is shown in paragraph 36 of Kim,
21 Exhibit 1009?

22 A Yes.

1 Q What is press density as discussed in Kim?

2 A In this case, it is the density after
3 pressing, which is somewhat similar to what is
4 done with the cathode layers although in this case
5 it is just the active material.

6 Q Is the press density of the active
7 material alone the same thing as the compaction
8 density of Kim's first active material layer?

9 A It is not exactly the same thing although
10 I think it probably overlaps potentially.

11 Q Why do you say it probably overlaps
12 potentially?

13 A Because in Kim at least an embodiment, I
14 think it is one of their examples, uses like -- a
15 little bit more than 94 percent of active material
16 powder and a little bit less than 3 percent each
17 of vinylidene fluoride and carbon -- I think
18 carbon black or acetylene black or some kind of
19 conductive additive.

20 And if you basically, you know, take the
21 average of these densities and add in these lower
22 density materials, it doesn't make a huge amount

1 of difference. And the other thing is that there
2 are multiple ways you could add in that lower
3 density material.

4 That lower density material could be added
5 in such a way that it contributes its full volume
6 or it could be added in such a way that at least
7 some of it goes into the interstices of powder.
8 And because there is such a small amount of it,
9 the density values that you would get are not much
10 different from the values given there. Like 3.31
11 could be a little bit lower like 3.2 or a little
12 bit higher. And certainly, for instance, 3.4
13 would be a little bit lower, but probably not
14 below 3.2.

15 So yeah, I mean, these densities do --
16 even though they don't include the binder, for
17 instance, do have something useful to say about
18 packing densities.

19 Q In the active material layer would there
20 also be pores?

21 A In the active material layer?

22 Q Uh-huh.

1 A Yeah, of course there are pores.

2 Q You say in paragraph 211 of your
3 declaration, which is on PDF page 110.

4 A Okay, hold on. Yeah, okay.

5 Q You say that Kim teaches a cathode layer
6 density of 3.31 grams per CC or greater and of 3.4
7 to 4.0 grams per CC, correct?

8 A Yes.

9 Q But those --

10 A That is what it says.

11 Q But those figures in paragraph 36 of Kim
12 are not describing the compaction density of the
13 active material layer. They're only discussing
14 the press density of the active material alone,
15 correct?

16 MS. KELLY: Object to form.

17 A Those numbers that are in the report
18 there, which come from paragraph 36 in Kim, are
19 for -- are listed as press densities.

20 Q And press density of an active material is
21 different -- it is a different characteristic and
22 a different measure than compaction density of an

1 active material layer, correct?

2 A They are related as I just explained at
3 some length, but they certainly are not the same
4 thing.

5 Q Kim's cathode active material layer also
6 includes a binder, correct?

7 A Yes, it does.

8 Q And do you know what the density of that
9 binder is?

10 A Yeah. I have -- I'm pretty sure that Kim
11 -- at least one of the binders Kim uses is
12 polyvinylidene fluoride. I would have to search
13 through here. Well, I think that that is one that
14 they use in their examples, right.

15 So example 6 of Kim is where they actually
16 make a cathode. And polyvinylidene difluoride is
17 what they call it, but that is basically PVdF, so
18 yes, that is what they used.

19 Q Thank you. Does example 6 tell you what
20 porosity was used?

21 A Let me -- yeah, Kim, I don't think -- let
22 me see, wait a minute. I'm trying to search this

1 Kim and it is not allowing me -- did you send me a
2 picture, a non-searchable one?

3 Q I think the PDF that we received in the
4 case was a non-searchable.

5 A Okay. Yes, this was an issue. There were
6 some of them that -- that had that problem. I
7 specifically asked counsel to send me searchable
8 versions of all the prior art yesterday, which I
9 have on a separate thing here in a separate folder
10 if you will allow me to --

11 Q That is totally fine. If you want to pull
12 a searchable version of Exhibit 1009, I have no
13 objection to that so long as there are no notes or
14 highlighting on it.

15 A Yes. Yeah, I specifically had them send
16 me a clean, searchable version yesterday.

17 So Kim I don't think discusses porosity,
18 which -- unless this is not searchable also. But
19 that is my recollection, right. I mean, some of
20 these things work -- are working with density and
21 some of them are working with porosity, and Kim is
22 talking about density. So I don't see porosity

1 taught or discussed.

2 Q Kim's press density that you cite, if you
3 look at paragraph 37, that press density is
4 defined, correct?

5 A Yes.

6 Q And press density in Kim refers to an
7 apparent press density when the composite cathode
8 active material powder is pressed at a pressure of
9 2.5 tons per cubic -- per square centimeter,
10 correct?

11 A That's what it says.

12 Q Do you know if that same pressure is
13 applied when forming the active material layer?

14 A I think we discussed earlier whether I
15 knew what the actual values were. And I said that
16 I did not know that off the top of my head, so I
17 can't -- I can't say.

18 I will say that that number sounds, you
19 know, very, very large, but it might not actually
20 be all that hard to apply that much pressure with
21 a roller that has got like a small point of
22 contact or a small line of contact. So I'm not

1 sure, I haven't thought about it.

2 Q And is it possible that the pressure that
3 is being applied to active material powder alone
4 might be a different pressure than is applied when
5 forming the active material layer?

6 A Well, sure, it -- it certainly could be.

7 Q And if a different pressure is applied, a
8 different density may result?

9 A It could.

10 Q Does the discussion of example 6 at
11 paragraphs 79 to 81 of Kim tell you what pressure
12 to apply or what porosity to use or what target
13 density to achieve?

14 MS. KELLY: Object to form.

15 MR. COX: Counsel, is your objection just
16 that it is three questions?

17 MS. KELLY: Yes.

18 MR. COX: I can ask them separately.

19 Q Okay. Looking at paragraphs 79 to 81 of
20 Kim where it discusses example 6, where the active
21 material layer is created --

22 A Yes.

1 Q -- does Kim tell you what pressure to
2 apply?

3 A It simply says the cathode plate was
4 pressed into a sheet form using a rolled press,
5 that is all it says.

6 Q So is that a no?

7 A Yeah. I mean, they don't -- they don't
8 tell you the things that you were asking about
9 basically.

10 Q Do paragraphs 79 to 81 of Kim tell you
11 what porosity to use for the active material
12 layer?

13 A Well, it doesn't. I mean, I just did a
14 search and the word porosity does not appear in
15 Kim.

16 Q And do paragraphs 79 to 81 of Kim tell you
17 what density to use for the overall active
18 material layer of Kim?

19 A Kim talks about density. I mean, Kim --
20 Kim has teachings about density at least with
21 respect to this press density. And so I think a
22 POSA would understand that you want to be pressing

1 to achieve similar densities.

2 Q Press density is only measured when
3 pressure is applied to the composite cathode
4 active material powder alone, correct?

5 A That is what Kim does in, I believe,
6 paragraph 37.

7 Q Do you know what would happen to an active
8 material layer for a cathode if a pressure of 2.5
9 tons per square centimeter were applied to it?

10 A I haven't thought about that.

11 Q The conducting agents, binders and
12 solvents in Kim typically have a lower density
13 than the active material does, right?

14 A The conductive agents and binders and the
15 solvent do have lower densities. Well, I don't
16 know what the -- what the density of NMP is, but I
17 suspect -- I suspect it is lower.

18 Q Would lower than about 2 grams per cubic
19 centimeter surprise you or would that feel about
20 right?

21 A No, that would -- that would -- it is --
22 yeah, that would feel about right. Yeah. Well, I

1 just Googled it and it is 1.03, so...

2 Q And that is grams per cubic centimeter?

3 A Yes.

4 Q Is it fair to say that adding the
5 conducting agents and binders will lower the
6 density of the cathode active material composition
7 compared to the press density?

8 A I think we discussed that. And -- and it
9 would if when they're added they also add their
10 full volume. That is, they don't go into any
11 interstices or anything, then they would certainly
12 lower the density by an amount in proportion to
13 their, you know, percentage in the composition.

14 If they go into interstices or what used
15 to be pore space and at least to some partial
16 degree and plug some of that up, then it might
17 actually increase the density a little bit
18 although I don't think that happened. You know,
19 neither one of those things is going to happen
20 exclusively. It is going to be somewhere in
21 between.

22 I could use a break.

1 Q Sure, yes.

2 (Recess, 2:33 to 2:38 p.m.)

3 Q Dr. Gido, could you go ahead and pull up
4 Exhibit 1005?

5 A Okay.

6 Q And do you recognize this document?

7 A Yes, this is the Wang reference. This one
8 again appears that it might --

9 Q It is not searchable?

10 A -- be not searchable, let me see. Yeah,
11 so let me again go to my backup here, okay.

12 Q This is the Wang reference that you rely
13 on in your declaration?

14 A It is.

15 Q If you look at paragraph 35 of Wang, which
16 is at PDF page 17?

17 A Right.

18 Q Wang describes cathode electrodes that
19 have varying porosity conductivity and particle
20 size throughout the structure, correct?

21 A That is what it says there, yes.

22 Q And so the different layers that you rely

1 on from Wang have different porosities, correct?

2 A Yeah, I'm not sure. I mean, I'm relying
3 on the teachings of Wang. I'm not quite sure
4 whether I, you know, how I used it. Whether I was
5 using, like, specific examples or whether I was
6 using the taught ranges or --

7 Q And feel free to --

8 A I actually -- I think, yeah, I think in
9 Wang I wasn't really -- I wasn't really using, you
10 know -- I was using Wang for -- well, I was using
11 Wang for everything but density. And since
12 density is related to porosity, I was -- I was not
13 using Wang's porosity necessarily either.

14 Q Wang teaches graded porosity, right, if
15 you look at paragraph 36?

16 A Yes.

17 Q And in particular it talks about how --

18 COURT REPORTER: Excuse me, my computer
19 just crashed and is restarting. Can we go off the
20 record?

21 MR. COX: Sure.

22 (Recess, 2:41 to 2:48 p.m.)

1 Q So Dr. Gido, before we had a slight
2 technical interruption I was asking you if the
3 different layers that you rely on from Wang have
4 different porosities?

5 A I believe that they -- they can. I mean,
6 you know, that seems to be the, you know, a
7 teaching of Wang, right. So Wang teaches
8 different polyvinylidene porosities for those
9 layers. And in fact, the first layer can be more
10 porous than the second layer or it can be the
11 other way around, but certainly Wang teaches a lot
12 of stuff about porosity.

13 Q You rely on Wang for teaching certain
14 layers and certain materials, correct, though you
15 say but not certain densities, correct?

16 A Yes.

17 Q Can you pick a new density for a given set
18 of materials?

19 MS. KELLY: Object to form.

20 A Can I pick a new density. Well, I mean,
21 you can't change the density of the fundamental
22 components, but you can change the percentages

1 they are combined in and you can change, for
2 instance, how the layer is pressed.

3 Q But at some point the density is a
4 function of the physical properties of the
5 materials that are being used and the porosity,
6 correct?

7 A Well, it is a function of the properties
8 of the materials being used and the porosity, yes.

9 Q For example, as an analogy, let's say I
10 have a patent on a vehicle and a piece of prior
11 art is the Hummer. Is that a vehicle you're
12 familiar with?

13 A Not personally, but I -- I have seen them
14 around, yes.

15 Q And I used that, you know, piece of prior
16 art, the Hummer, to get certain size and dimension
17 characteristics for my vehicle. And then the
18 patent claim also requires gas mileage of 90 miles
19 per gallon. And then I say, well, I will just
20 combine the Hummer with a different car that gets
21 90 miles per gallon, then I have a Hummer that
22 gets 90 miles per gallon.

1 Is that a thing you can do? Are those
2 combinable?

3 A Well, I'm -- I'm not sure. I mean, maybe
4 if you had a hybrid Hummer or a electric Hummer or
5 a nuclear-powered Hummer, you know, but it would
6 be challenging.

7 Q My question is, how can you just pick a
8 density value from a different reference and say,
9 I'm going to apply this density value to the
10 materials and layers and structures in the first
11 reference to get a new density value? Can you
12 explain that to me?

13 A Well, a POSA would look at one reference
14 and they would look at another reference that
15 teaches -- the first reference doesn't teach any
16 density values. And then they would look at
17 another reference which suggests that, you know,
18 in order to maintain, for instance, good battery
19 capacity, because all of these references want to
20 do that.

21 I mean, they all have sort of other
22 motivations like rate performance, or preventing

1 short-circuits or what have you, but they all want
2 to maintain high energy capacity. And so another
3 reference teaches certain density ranges and a
4 POSA would read those density ranges and would
5 apply those to the first reference.

6 I mean, it may take some experimentation
7 to find the, you know, offsetting design criteria
8 to make it work, but that would be what the POSITA
9 would draw from the second reference that gives --
10 gives them density ranges.

11 Q Wang teaches that the porosity of its
12 first porous layer is greater than the porosity of
13 its second porous layer, correct?

14 A I think that is one version of Wang. I
15 think that they also teach it the other way
16 around, but that is certainly something that Wang
17 teaches.

18 Q And if you look at paragraphs 56 and 57 of
19 Wang, it teaches that each porous layer -- sorry,
20 is at least a porosity of 20 percent and the other
21 porous layer is at least a porosity of 40 percent,
22 correct?

1 A Yeah, this goes on for some time and is
2 iterated and sort of flipped the other way and so
3 forth, but certainly I'm seeing 20 percent there
4 and 40 percent there as -- as values that are on
5 the lower end or defining that range on the lower
6 end.

7 Q And the porosity values of Wang are key to
8 Wang's invention, correct?

9 A I am not sure. I mean certainly that is
10 part of the invention. I don't know whether --
11 let's see. In certain embodiments -- I'm just
12 looking for what Wang says about that and to what
13 degree they credit that particular feature. Yeah,
14 I mean, their -- you know, their thing seems to be
15 graded porosity. So okay, fair enough.

16 Q And my question is, do you know if you can
17 achieve the claimed compaction density of the '118
18 patent's claims while maintaining Wang's targeted
19 porosity?

20 A I don't know that off the top of my head.
21 That would be a calculation that, you know, would
22 have to be done. I did not do that calculation.

1 Q And when you combined Wang and Saka, you
2 did not take into account Wang's porosity values
3 in your calculations, correct?

4 A Well, I did calculations for Saka, I
5 didn't really do any calculations for Wang. So
6 the calculations I did for Saka were sort of --
7 were self-contained within the teachings of Saka.

8 Q So when you combine Wang and Saka, explain
9 to me why you believe a POSITA would be motivated
10 to make that combination?

11 A Well, the reason why is, as I state in my
12 declaration, that Wang doesn't specify densities.
13 And that a POSA would be interested in density
14 that they would want to use, because that impacts
15 on battery capacity, which is something that both
16 Wang and Saka want to maintain. It may not be
17 their primary overriding motivation, but it is
18 always a secondary motivation to maintain good
19 energy capacity.

20 And so given that Wang has not specified a
21 density, a POSA would look to Saka for values.

22 Q Why does a POSA implementing Wang need to

1 know a density?

2 A Well, I mean, they would want to know the
3 density, you know, if nothing else, that that may
4 be an easier property to measure than porosity.
5 So if you are trying to do some product
6 development and you are making different samples
7 and so forth, it may be more convenient to work
8 with density rather than porosity.

9 Q If you know the total density of all the
10 materials you used in your active layer, then it
11 is not that difficult to calculate the porosity of
12 the layer, correct?

13 A From the density and from the active
14 materials. I mean, you can certainly do a
15 calculation. If you want to be completely
16 accurate, I might also do some kind of a
17 measurement, like, you know, mercury intrusion
18 pore symmetry or something like that just to make
19 sure, because you know, theory is theory and it is
20 not always 100 percent accurate.

21 But yeah, I mean it is -- it is possible
22 to convert. It is just like we were talking with,

1 you know, particle distributions before. You can
2 always just convert things.

3 Q It is essentially just a ratio of the
4 maximum theoretical density that you calculated
5 earlier, right, is how you figure out the
6 porosity?

7 A The ratio of the measured density to that
8 maximum theoretical density is --

9 Q Is 1 minus the porosity?

10 A Yeah, yes.

11 Q And so if Wang knows the materials that he
12 is using and Wang knows the porosity of the
13 layers, why does Wang further need to go looking
14 for density?

15 A Well, I just think a POSA might want to do
16 that, because it might be simpler than doing a
17 calculation which, you know, is theoretical and,
18 you know, might not actually give you an accurate
19 result. And so yeah, you can -- you can go and
20 look up densities as an alternative as a -- as a
21 way to practice the invention. Well, yeah, go
22 ahead, yeah, whatever.

1 Q Did you calculate the compaction density
2 that would be achievable while maintaining Wang's
3 desired porosity?

4 A I did not.

5 Q Paragraph 43 of Wang lists possible active
6 materials, correct?

7 A Okay. Hold on a second, yes.

8 Q And these are exemplary lithium-containing
9 oxides as well as a few non-lithium compounds --

10 A Yes.

11 Q -- performed?

12 A Yes, yes.

13 Q And would all of these densities be known?

14 A Probably. I mean, I -- I haven't checked
15 on all of them, but I'm sure they are. Certainly
16 the common ones that, you know, that Wang and Saka
17 and other prior art and the '118 patent actually
18 use are.

19 Q What is the optimal porosity for an active
20 material layer comprising lithium cobalt oxide or
21 LCO?

22 MS. KELLY: Object to form.

1 A What is the optimum porosity?

2 Q Yes.

3 A Again, it depends on what you are trying
4 to optimize, right? Are you trying to optimize
5 rate performance, are you trying to optimize
6 capacity. You are trying to, you know, address
7 some of the other kinds of features that prior art
8 talks about. So I think the optimum depends on
9 what you are trying to do.

10 Q Would your answer be the same if I ask the
11 same question about lithium iron phosphate?

12 A Yes.

13 Q Do you know if the optimum porosity for
14 lithium cobalt oxide and for lithium iron
15 phosphate would be the same?

16 A Again, well -- well, first of all, it
17 depends on whether you're talking about -- you
18 know, what parameter you are optimizing for, what
19 performance feature you are optimizing for. And
20 secondly, I suspect that -- I think that they
21 would not necessarily be the same.

22 Q Paragraph 67 of Wang discusses using --

1 strike that.

2 Paragraph 67 of Wang discusses using an
3 optional compression process, correct?

4 A Yes, that is what it says.

5 Q The compression process is a way of
6 adjusting the porosity, correct?

7 A Well, yeah, it is -- it is a way of
8 adjusting the density which would also then
9 involve adjusting the porosity. It says, to
10 achieve the desired density. So -- so Wang is
11 concerned about density, but certainly as we
12 discussed, the density and porosity are related.

13 This is odd. I'm becoming fuzzy let me --

14 Q Do you want to take a minute?

15 A No, no, no, I am going to just not blur my
16 background anymore.

17 Q Oh, you just mean -- you just mean the
18 video.

19 A Oh, do you know what it is?

20 Q I thought you yourself were becoming
21 fuzzy.

22 A No, no. My -- my video that is just --

1 Q You are getting a sunbeam coming in your
2 window there.

3 A It is a sunbeam coming in the window. So
4 as long as we're okay with that, you know, we can
5 continue.

6 Q I will say I'm fine to proceed, because I
7 don't have any plans to play this deposition
8 testimony as video, so unless Ms. Kelly want us to
9 stop and adjust.

10 MS. KELLY: I think it is fine.

11 Q Okay. So the question I asked was the
12 compression process is a way of adjusting the
13 porosity, correct? And you had just said that
14 density and porosity are related before we had the
15 sunbeam come in.

16 A Yeah. I had -- I had basically said that
17 the -- that the paragraph that you pointed me to
18 talked about achieving a desired density rather
19 than porosity, which although I agree that the two
20 are related, you know, that is some teaching of
21 Wang that would make a POSA say, porosity, okay.
22 I mean -- I mean, would say density, desired

1 density, okay, so what should that be.

2 And maybe they would do a calculation,
3 based on porosity, but maybe they would just also
4 try and look for an appropriate density. So yes.
5 I think they might want to look for an appropriate
6 density.

7 Q Can a compression process adjust the
8 density without affecting the porosity?

9 A I wouldn't rule it out, but I can't think
10 of any way. I can't think of how it would off the
11 top of my head.

12 Q Can a POSITA manufacture a working battery
13 using Wang's disclosure?

14 A Using Wang's disclosure?

15 Q Yes.

16 A I would say they could make a battery of
17 some sort, particularly if nothing else because I
18 believe Wang does. Let me look at Wang's
19 examples, but I believe that, you know, she makes
20 a battery.

21 Q You don't contend that the instructions in
22 Wang are insufficient for a POSITA to know how to

1 make a battery according to Wang's instructions,
2 correct?

3 A I think that Wang does have teachings in
4 it on how to make a battery. I'm having a hard
5 time finding Wang's examples. We were just
6 looking at them. Well, maybe Wang doesn't --
7 yeah, maybe Wang doesn't have examples. Which one
8 were we looking at that had examples? Oh, it was
9 Kim that had -- I was looking for example 6 in
10 Wang, but that was actually Kim.

11 So there don't seem to be any examples
12 doing a -- a -- a search of examples in Wang and
13 I'm not finding any.

14 So it is not entirely clear that they
15 actually construct a battery. They certainly
16 provide a lot of information and, you know,
17 whether or not that is sufficient -- a lot of the
18 information is about machinery, right.

19 I mean these -- these inventors are at
20 Applied Materials, which is a company that makes
21 like processing equipment mainly for making
22 semiconductors. But also then -- so they're

1 talking about processing equipment for making
2 batteries. So it is not entirely clear to me
3 that -- you know, they don't give instructions
4 necessarily on how to make a battery absent all
5 kinds of fancy equipment.

6 So I mean, you know, I think that -- that
7 a POSA would read this and a POSA would have some
8 experience and would, you know, be able to do
9 something. But I think the teachings of Wang may
10 be somewhat incomplete in necessarily allowing
11 somebody to -- allowing a POSA to, you know, in a
12 laboratory, for instance, to make a prototype
13 battery.

14 Q Wang does teach how to manufacture a
15 cathode, correct?

16 A Again, I think they -- they -- they do in
17 some sense, but it is related to -- I think to --
18 to, you know, complicated equipment, and
19 complicated industrial scale processes rather than
20 a POSA simply trying to make something as in, you
21 know, some of the other examples in some of the
22 other prior art.

1 Q Figures 6 and 9 of Wang provide process
2 steps for how to manufacture a cathode, correct?

3 A Figures 6 and 9. Yeah, they give a block
4 diagram, so it provides, you know, very general
5 steps, which again I think they fill in with
6 reference to their complicated machinery, but
7 it -- it does provide sort of basic -- basic
8 operations.

9 Q Let's go to Exhibit 1006, Saka. You can
10 put Wang away.

11 A Okay, all right, hold on a second, let me
12 see this. Okay.

13 Q Saka teaches a lithium iron phosphate
14 active material, correct?

15 A Well, one of them.

16 Q Do you rely on any embodiment that is not
17 a lithium iron phosphate active material in your
18 combination?

19 A Well, Saka teaches two layers, one of
20 which is NCM and the other one is LFP and NCM.

21 Q If you replaced LFP with a different
22 active material, you would have different

1 compaction densities, correct?

2 A Yes, you could, if it had a different
3 density.

4 Q If you look at paragraph 8 of Saka for me,
5 that is Exhibit 1006.

6 A Okay.

7 Q Do you see where this says, When the mixer
8 density increases, the area of pores in the area
9 decreases and the amount of an electrolytic
10 solutions which can be stored in the positive
11 electrode mixture layer decreases. As a result, a
12 contact ratio between the positive electrode
13 active material and the gas-producing agent
14 contained in the electrolytic solution decreases
15 and the amount of gas produced during overcharge
16 decreases.

17 Do you see that section?

18 A I do.

19 Q Does this provide a reason why a higher
20 density might be undesirable for a cathode?

21 A Well, I mean, certainly yeah. I mean, it
22 says what it says. And we know that when you

1 increase the density, well, the areas of the pores
2 in the layer would decrease.

3 Q And for the reasons that we -- sorry, go
4 ahead.

5 A No, I was saying that is not surprising.

6 Q And for the reasons we discussed earlier,
7 it is not always desirable to increase compaction
8 density, correct?

9 A Well --

10 MS. KELLY: Object to form.

11 A You don't want to do it willy-nilly. You
12 need to -- you want to work at higher compaction
13 densities within other constraints that are
14 important to you in designing the battery, right.
15 So you -- you certainly need this porosity. And
16 depending on what your goals are, you want -- may
17 want more porosity or less porosity.

18 Q Saka wants more porosity, correct?

19 A I'm not sure about that. I think -- yeah,
20 the version of Saka that I opened as an exhibit is
21 again, not searchable, so let me go to another
22 Saka. Saka mentions porosity twice.

1 Q My question was about Wang, I believe.

2 A Oh, I thought you were asking me about
3 Saka, and what Saka's goal of porosity for
4 porosity was. You asked me about Wang's goal for
5 porosity.

6 Q I meant to say Wang, I apologize. Wang
7 wants more porosity, correct?

8 A Wang certainly teaches certain ranges of
9 porosity.

10 Q Would you characterize those ranges of
11 porosity as high ranges of porosity?

12 A Well, some values are high, some values
13 are not so high.

14 Q Wang teaches that in at least several of
15 its embodiments at least one of the layers should
16 have a porosity of 40 percent to 70 percent,
17 right? And you can reopen that exhibit.

18 A No, I am. I just -- I closed Wang, but --
19 but no, that is my recollection, that -- that
20 those are ranges that not Saka -- I mean, not
21 Saka, Wang -- certainly that Wang recites, yes.

22 Q Would you turn to paragraph 51 of Saka,

1 which is on PDF page 17 of Exhibit 1006?

2 A Which paragraph did you say, 61?

3 Q 51, 51?

4 A 51, yeah. I'm -- I'm there. This is
5 referring to Figure 4?

6 Q Uh-huh. And you rely on and cite this
7 paragraph in your report for the proposition
8 stated at the bottom of this paragraph, that the
9 mixture density of the positive electrode mixture
10 layer 12 is, for example, 2.5 grams per cubic
11 centimeter to 3.5 grams per cubic centimeter,
12 correct?

13 MS. KELLY: Object to form.

14 A That -- that sounds right, although I
15 would like to confirm that in my declaration.

16 Q Sure. You can look at paragraph 277 of
17 your declaration.

18 A Yes, I see that.

19 Q Does Saka ever teach that a mixture
20 density of 3.2 grams per cubic centimeter or
21 higher is desirable or preferred?

22 A There is a range listed here and 3.2 is in

1 that range. I did some calculations and the --
2 yeah, I did some -- well, I did some calculations
3 that were in that range, but no, Saka does not
4 necessarily draw any distinction.

5 Q And every working embodiment that Saka
6 makes has a mixture density of 3.0 grams per cubic
7 centimeter or lower, correct?

8 MS. KELLY: Object to form.

9 A I think -- I believe that is my
10 recollection. I would have to go back and look at
11 this table, Table 1, Figure 7.

12 Yes, they're almost all -- they're almost
13 all 3, but there is a couple that are 2, I guess,
14 3. There is a few that are a little lower, but
15 they're mostly 3.

16 Q Some are 2.7, some are 2.9. And if you
17 continue to figures 10 and 11, some are also 2.8?

18 A Figure 10, okay.

19 Q So my question is, does Saka teach any
20 working embodiment that has a mixture density
21 above 3.0?

22 MS. KELLY: Object to form.

1 A Well, I mean, Saka gives these examples,
2 so those are the densities in the examples. You
3 know, to the extent that they offered teachings
4 that might allow a higher density in a working
5 embodiment, they do teach that. But the ones that
6 they made, have the densities listed in those
7 tables.

8 Q Do you know what active material taught in
9 Saka would allow you to have a compaction density
10 of above 3.2 grams per cubic centimeter, if any?

11 A Well, it would also depend. I suppose it
12 would depend on the porosity and it would depend
13 on the materials. And I don't recall -- I mean, I
14 didn't -- I did not do that calculation, so I
15 couldn't -- couldn't tell you.

16 Q Does anything in Saka provide a teaching
17 or motivation or reason to try for a person of
18 skill in the art to use a density in excess of 3.2
19 grams per cubic centimeters?

20 A Well, as I think I cited, a teaching --
21 that there is a range -- that Saka is teaching a
22 range that can go up to, what, 2.5 to 3.5 or

1 something. Again, I'm -- yeah, 2.5 to 3.5, so
2 that is what it teaches.

3 Q And my question is, for a person of skill
4 in the art implementing Wang, what teaching or
5 motivation is there to select a value at the top
6 of that range as opposed to one of the multiple
7 working embodiments that Saka teaches?

8 MS. KELLY: Object to form.

9 A Well, the motivation, again, would be
10 maintaining high energy density, if that is
11 important. And a POSA would believe that is
12 important, because that is a goal, in fact, of
13 Wang and of, in fact, all the prior art and the
14 '118 patent.

15 Regardless of what any of them are trying
16 to do, they all want to maintain a high energy
17 density, which means that you basically want to
18 get a higher packing density within the
19 constraints of the other things you are trying to
20 optimize.

21 Q Are some of the other things you're trying
22 to optimize the porosity levels taught by Wang?

1 A Well, I'm more thinking in terms of the
2 issues like rate performance taught by Wang. So
3 porosity is not necessarily something you -- I
4 mean, when I'm talking about optimizing, I'm
5 optimizing sort of a final kind of property of the
6 battery characteristics, not necessarily a
7 underlying structural feature.

8 And so porosity is an underlying
9 structural feature that you might modify to give
10 the battery certain battery performance
11 characteristics.

12 Q Do you know if it is possible to achieve a
13 compaction density of 3.2 grams per cubic
14 centimeter or above while simultaneously
15 maintaining the taught porosities of Wang?

16 A I haven't done that calculation.

17 Q If you go to --

18 A If you don't mind, I would like to take a
19 quick break.

20 MR. COX: No, you are good.

21 (Recess, 3:34 to 3:38 p.m.)

22 Q Dr. Gido, could you turn to paragraphs 278

1 through 280 of your declaration?

2 A Okay.

3 Q Here you are discussing the combination of
4 Wang and Saka.

5 A Yes.

6 Q In paragraphs 278 and 279, the only
7 citation to Saka you make is Figure 5, correct?

8 A I see that it is -- yeah, I'm using Figure
9 5 there. That same -- similar figure is repeated
10 in Saka multiple times, but, yeah, I'm using that
11 particular -- particular version of it.

12 Q And this is the figure that you have
13 annotated on PDF page 134?

14 A Yes.

15 Q In paragraph 280 your only citation to
16 Saka is Saka's paragraph 7, right?

17 A Yeah, that is -- that is what it says
18 there, let's see. Yeah, that is -- that is what
19 it says.

20 Q And you have a quote from paragraph 7 of
21 Saka in a parenthetical. Do you see that?

22 A I see that.

1 Q It says, In order to maintain the battery
2 capacity, it is necessary to improve the filling
3 factor, that is, the mixture density of a positive
4 electrode mixture layer. Do you see that?

5 A I do.

6 Q If you go to paragraph 7 of Saka, that is
7 not the full quote, correct?

8 A Yeah.

9 Q What Saka actually says is, Accordingly in
10 order to maintain the battery capacity, it is
11 necessary to improve the filling factor, that is
12 the mixture density of a positive electrode
13 mixture layer depending on the mixing amount of
14 lithium iron phosphate?

15 A I see that.

16 Q Is that omission of the discussion of
17 lithium iron phosphate and the mixture densities
18 dependence on the mixing amount of lithium iron
19 phosphate intentional in your declaration?

20 A No, not on my part. Certainly lithium
21 iron phosphate does have a somewhat lower density
22 than NCM. So that is why -- that is why it is

1 sort of, you know, called out here.

2 Q And --

3 A But it is still teaching you that
4 basically you want to improve the filling factor,
5 which is kind of like the opposite of porosity.
6 It is related to density.

7 Q Does paragraph 7 of Saka mention any
8 active material besides lithium iron phosphate?

9 A A quick scan of the paragraph suggests
10 not.

11 Q Do any of the paragraphs that you cited
12 from Saka discuss having different porosity values
13 in different layers of a cathode?

14 A In Saka?

15 Q Yes.

16 A Saka -- and again, I've got so many of
17 these things -- unfortunately, yeah, this is Saka.
18 When Acrobat stacks these things along the top of
19 the bar, I can't see -- it cuts off the -- the
20 title. I don't know -- I don't have these numbers
21 memorized, so I need to see whether it says Saka
22 or not and that is at the end.

1 Q That is 1006.

2 A Okay. I just don't want to be looking at
3 -- I've got Wang here, I've got Saka, I've got --
4 as I don't want to be saying the wrong -- I've
5 already said the wrong thing once, because I was
6 looking at the -- at the wrong one.

7 So yeah, I mean, Saka only mentions
8 porosity twice. And at paragraph 14, it is
9 talking about the porosity of the -- of the
10 positive electrode mixture layer in comparison to
11 the porosity of the separator. But at any rate,
12 so it is talking about the porosity of the -- of
13 the cathode layer, but, you know, kind of as -- as
14 the opposite of Wang, it -- it doesn't really talk
15 about porosities. It talks about densities.

16 Q Let's go to Li Exhibit 1003.

17 MR. COX: Ms. Klinger, this is Li, L-i.

18 A Yes. Actually, again, can I close Kim?

19 Q Sure.

20 A So now you want me to go to Li?

21 Q Yes, please.

22 A Again, I'm just going to save the --

1 Q This -- this one, I think, is searchable.

2 A I was going to say I would save the step
3 and go -- but okay.

4 What exhibit did you say it was?

5 Q 1003.

6 A Okay. It is searchable, okay.

7 Q Do you recognize this document?

8 A I do.

9 Q And this is another piece of prior art
10 that you rely on in your declaration?

11 A It is.

12 Q If you go to paragraph 38, which is on PDF
13 page 11.

14 A Okay.

15 Q You rely on a statement here that says,
16 The positive electrode was compacted to a density
17 of 3.8 grams per cubic centimeter.

18 A Yes.

19 Q Does this paragraph discuss the particle
20 size of the LCO powder?

21 A It doesn't.

22 Q Does it discuss the porosity of the

1 particles or of the layer?

2 A The porosity of the particles
3 themselves --

4 Q Or of the layer?

5 A -- or the porosity of a powder, for
6 instance?

7 Q Either one?

8 A It does not.

9 Q Does Li teach the specific particle size
10 distribution of the lithium cobalt oxide powder
11 that it used?

12 A I don't believe it does.

13 Q Does it provide a commercial name that
14 would allow you to figure out that particle size
15 distribution?

16 A I don't see that.

17 Q If you go to paragraph 44.

18 You rely on this as disclosing a coating
19 density of 4.1 grams per cubic centimeter,
20 correct?

21 A That is what it says.

22 Q And I'm going to have the same set of

1 questions here.

2 Does this paragraph discuss the particle
3 size of the lithium cobalt oxide particles?

4 A I don't recall it doing so. Let me check
5 and make sure, but no, I don't believe so.

6 Q Does it teach a particular particle size
7 distribution for those particles?

8 A No, it doesn't appear to.

9 Q Li teaches applying the same active
10 material in two different steps, not different
11 active materials, correct?

12 A That is my recollection, let's see. Yeah,
13 that -- I believe that is what it is teaching,
14 yes.

15 Q Do either paragraph 38 or 44 provide any
16 explanation or reason for why their specific
17 density values were selected?

18 A No.

19 Q Do they provide any reason for why those
20 values are desirable?

21 A Not in those paragraphs. They do say up
22 -- earlier in the patent again there is a -- I

1 think a paragraph -- let's see, where is that.

2 They do -- they do say somewhere in here
3 that, again, that they are trying to get a high
4 packing density to get high battery capacity or to
5 not compromise battery capacity while they're
6 doing the main thing that they're trying to do,
7 which is this electrode folding business. But
8 yeah, but not in the paragraphs that you were --
9 you had me directed towards.

10 Q Paragraph 408 of your declaration, Exhibit
11 1010, you say that Li discloses numeric values for
12 the compaction densities that work in a battery
13 like Wang's or like the '118 patent. Do you see
14 that?

15 A This is which paragraph?

16 Q 408, PDF page 189.

17 A Okay. Yeah, that is -- wait.

18 Q The first sentence of paragraph 408.

19 A Okay, I see it.

20 Q How do you know that the numeric values
21 disclosed by Li would work in Wang's battery?

22 A Well, I mean --

1 MS. KELLY: Object to form, sorry.

2 A Yeah, Wang teaches certain materials and
3 teaches making a cathode out of them, but doesn't
4 specify density. You know, it says there is a
5 desired density, but doesn't say what it is.

6 And Li teaches densities, which I did find
7 that it is -- paragraph 27 of Li that they talk
8 about achieving good energy density to improve
9 battery performance.

10 So -- so somebody practicing Wang would
11 look to Li for density values to -- to use.

12 Q Do you know if Li's density values could
13 be achieved while maintaining Wang's targeted
14 porosity values?

15 A I have not done that calculation, so I
16 don't know.

17 Q Is there anything in Li that confirms that
18 Li's active materials have the same particle sizes
19 as Wang's active materials?

20 A I think we just discussed that Li does not
21 say anything about particle sizes.

22 Q Is there anything in Li that tells you

1 what its porosities are in the active material
2 layer?

3 A Not that I recall, although let me do a
4 quick search. It doesn't appear -- it doesn't
5 appear that it does.

6 Q There is no discussion of porosity in Li
7 at all other than the discussion of a
8 polypropylene porous membrane for the separator,
9 correct?

10 A That is the only place in Li that I can
11 find where porous or porosity is mentioned.

12 Q At 44 of Li, that is PDF page 12,
13 discusses coating in an intermittent manner with
14 gap coating size parameters, correct? That
15 language is on PDF page 13.

16 A Yes, I see that.

17 Q What does it mean that these electrodes
18 were coated merely in an intermittent manner with
19 gap coating size parameters?

20 A Well, that is a big part of Li's invention
21 is that it makes a two-layer cathode, but
22 intermittently you don't put the second layer on

1 in order to leave thinner regions in the cathode
2 to allow bending at corners when you make a
3 prismatic battery geometry like a rectangular
4 geometry.

5 Q The active material that is applied in
6 what you describe as the second layer is the same
7 active material that is applied in what you
8 describe as the first layer, correct?

9 A I think that is the case, yes.

10 Q And so to your earlier analogy, this is a
11 second swipe of the paintbrush, but it is the same
12 bucket of paint that is being used, correct?

13 MS. KELLY: Object to form.

14 A That appears to be the case.

15 Q Does intermittent coating, would it
16 require compaction?

17 A I think that it said -- well, I mean, in
18 this particular Li reference, they talk about
19 coating twice and compacting twice. I mean, in
20 general, you could coat something twice and not
21 compact, but in what Li is teaching, they are
22 coating twice and compacting twice.

1 Q Does Li indicate that this intermittent
2 coating method is limited to only certain
3 compaction densities?

4 A Not particularly.

5 Q Could the same process of intermittent
6 coating be performed on a cathode that has a
7 density of 3 grams per cubic centimeter?

8 MS. KELLY: Object to form.

9 A Presumably the intermittency of the
10 coating process is kind of a separate thing as
11 opposed to whether you compact it once you have
12 gotten it down.

13 Q So could a POSITA seeking to take
14 advantage of Li's intermittent layers simply
15 implement those intermittent layers on Wang
16 without adjusting the density of Wang?

17 A Well, again, I believe because both Li and
18 Wang cite a desire to maintain high energy
19 capacity, they would want to compact either once
20 or twice during the process.

21 MR. COX: Just give me two minutes to
22 confirm I'm wrapped up and then if I am,

1 Ms. Kelly, I will pass him over to you.

2 A Okay.

3 (Recess, 4:05 to 4:07 p.m.)

4 Q I'll pass the witness. Thank you for your
5 time, Dr. Gido.

6 A Thank you.

7 MS. KELLY: We have no redirect.

8 MR. COX: Thank you.

9 (Deposition adjourned at 4:07 p.m.)
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CERTIFICATE OF SHORTHAND REPORTER

I, Susan S. Klinger, Certified Reporter
before whom the foregoing deposition was taken, do
hereby certify:

That SAMUEL GIDO, PH.D., the witness whose
deposition is hereinbefore set forth, was duly
sworn by me before the commencement of such
deposition, and that such deposition was taken
before me and is a true record of the testimony
given by such witness, that said testimony was
taken by me stenographically and thereafter
reduced to typewriting under my direction.

I further certify that the adverse party,
Petitioner was represented by counsel at the
deposition.

I further certify that the deposition of
SAMUEL GIDO, PH.D., occurred remotely on the 12th
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I further certify that reading and signing
was not discussed.

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1 I further certify that I am not related to
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7 IN WITNESS WHEREOF, I have herunto set my
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9

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11

12

Susan S. Klinger, RMR-CRR, CSR

13

Texas CSR 6531, Exp: 10/31/27

14

California CSR 14487, Exp: 11/30/26

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