Transcript of Yanliang Liang, Ph.D.

Date: July 2, 2024
Case: Samsung Electronics Co., LTD -v- RJ Technology, LLC (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

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

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner
V.
RJ TECHNOLOGY LLC,
Patent Owner.

Case IPR2023-01183
Patent No. 7,749,641

REMOTELY CONDUCTED VIDEOTAPED DEPOSITION OF
YANLIANG "LEONARD" LIANG, PHD
TUESDAY, JULY 2, 2024
9:02 A.M. CT

JOB NO.: 541896
PAGES: 1 - 149
REPORTED BY: KARISA EKENSEAIR, CCR RPR RMR

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DEPOSITION OF YANLIANG "LEONARD" LIANG, PHD, CONDUCTED VIA ZOOM VIDEOCONFERENCE.

Pursuant to notice, before Karisa J. Ekenseair, Certified Shorthand Reporter in and for the States of Arkansas, Oklahoma, Illinois, Missouri, Tennessee, Georgia, New Mexico, Washington, and California; National Registered Professional Reporter; National Registered Merit Reporter; Notary Public in and for the State of Arkansas.

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PROCEEDINGS

THE VIDEOGRAPHER: Here begins Media No. 1 in the videotaped deposition of Dr. Yanliang "Leonard" Liang.

My apologies about that. There we go. I just lost that -- lost -- excuse me.

In the matter of Samsung Electronics Company Limited versus RJ Technology, LLC before the Patent Trial and Appeal Board, Patent Case Number IPR2023-01183. Today's date is July 2, 2024. The time on the video monitor is 9:02 a.m.

The remote videographer today is Dominic Merlo representing Planet Depos. All parties of this video deposition are attending remotely.

Would counsel please voice-identify themselves and state whom they represent.

MR. SOMMER: Andrew Sommer on behalf of the petitioner.

MR. ZHOU: Robert Zhou of Kobre & Kim on behalf of patent owner RJ Technology, LLC. With me here today is George Stamatopoulos also of

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Kobre & Kim, and Mitch Yang of Carmichael IP.

THE VIDEOGRAPHER: Great. Thank you so much.

The court reporter today is Karisa Ekenseair representing Planet Depos. The witness will now be sworn.

YANLIANG "LEONARD" LIANG, PHD
of lawful age, being first duly sworn, deposes and says in reply to the questions propounded as follows:

EXAMINATION

BY MR. SOMMER:

Q Dr. Liang, is -- is that the right pronunciation of your last name?

A That is correct.

Q Dr. Liang, have you been deposed before?

A No. I haven't.

Q This is your first deposition. I'm going to ask a series of questions today. I'm going to do my best to ask clear questions. If you answer my question, I'm going to assume that you understood it; is that fair?

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A Yes. It is.
Q Please wait until I complete my question before you begin any answer; is that fair?
A Yes. That's fair.
Q And it's important that your answers to my questions be spoken and not just head nods or gesticulation; is that fair?
A Yes.
Q And that's because we have a court reporter here taking down everything that we say.
Do you understand?
A Yes. I understand.
Q Okay. Now, you signed a declaration in this proceeding; is that correct?
A That is correct.
Q And do you have a copy of that declaration in front of you today?
A Yes, I do.
Q Okay. If at any point in time you need to see certain materials referenced in that declaration because you don't have copies of it, let me know. We can show them on the screen for you; is that fair?
A Yes. Thanks.
Q Okay. At page 24 of your declaration, is that your signature?
A That is correct.
Q And you understand that you signed this declaration under penalty of perjury; is that fair?
A Yes.
Q And do you believe that the contents of the declaration are accurate?
A It is accurate to my knowledge.
Q Okay. What -- did you review the declaration to prepare for today's deposition?
A Yes, I did.
Q Did you notice any mistakes as you reviewed your declaration?
A I did catch one mistake I would like to bring it up to correct, but I'm not sure it's -- it's critical for our deposition.
Q Well --
A So it's -- okay.

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Q Yeah.
A So I'll just bring up the typo I caught during the review. It is -- let me see here. It is at paragraph 41.
Q Okay.
A 41 and line 3. There's a claim that the areal loading of about 4 milligram percent centimeter square but, in fact, the 4 should be a 7.
Q Okay. So that line in paragraph 41 should read diameter of 7.14 millimeter and an areal loading of about 7 milligrams per centimeter squared, period; is that right?
A That is right.
Q Okay. Now, you said you didn't think that that was going to matter for your deposition.
Why do you believe that?
A Because I have also provided this information in the data we produced to you, I believe. And you can find that the areal loading from that file is actually 7 instead of 4 and this 4 is a typo.

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Q Okay. What is areal loading?
A Areal loading in this specific context means that my electrode has about 7 milligram of active material over an area of 1 centimeter square.
Q And is the areal loading of an electrode an important characteristic of the electrode?
MR. ZHOU: Objection, form.
A That depends on the -- the context. Sometimes it is important; sometimes it's not at all.
Q Under what circumstances would the areal loading be unimportant?
A There are many possible circumstances where the areal loading is not important. For example, in this case, I'm trying to understand the capacity and voltage profile of the cathode material. And for this specific purpose, the areal loading, unless it's too large should have minimal impact on the result we get.
Q When you say too large, what do you mean?
A In the industry there's a general

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understanding of what is too large, but that depends on the battery system. In this case, I do not believe 4 or 7 would be too large.
Q How large would be too large in this context?
A I have not formed an opinion on that.
Q So would it be fair to say that you can't say how large is too large today?
MR. ZHOU: Objection, scope.
A I can tell you that the number we are seeing today, 4 or 7, would not be too large. I have not formed an opinion of what can be considered too large.
Q Okay. So would it be fair to say that you have no opinion of whether 10 would be too large for the areal loading?
MR. ZHOU: Objection.
A I have not formed an opinion on that.
Q Okay. Now, under certain circumstances can the areal loading impact the capacity loss of the battery?
MR. ZHOU: Objection, scope.

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A I have not formed an opinion on that.
Q Why did you report areal loading in paragraph 41 of your declaration?
A Because it has to do with my cell design and I think it would be good to include this information.
Q Why did you think it would be good to include the information?
A I believe including ample of information would be easier for an examiner on this declaration that I'm making.
Q Okay. And you -- you thought areal loading was -- was part of your inclusion of ample information, correct?
A That is correct.
Q Dr. Liang, you mentioned you have your declaration in front of you.
Do you have any other papers in front of you to aid with your testimony today?
A I also have print-out versions of references cited in my declaration.
Q Okay. So you would have a copy of

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Exhibit 2017; is that right?
(Exhibit 2017 marked for identification.)
A I would have to see what is -- what is number is that?
Q 2017.
A 2017. I would have to look at the definition of 2017 first. Give me a second, please, if you would.
So in my declaration, 2017 should be a paper published in 2002 by Kajiyama. Is that the same document you're referring to?
Q Yes, sir.
A I do have that document in front of me printed.
Q Okay. And you were -- were you looking at your computer screen for assistance in answering that?
A That is correct.
Q What were you looking at on your computer, sir?
A It is a digital version of my declaration and also your image.

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Q Okay. I hope my face wasn't helping you answer that question.
So with respect to other exhibits, do you have an Exhibit 2021? It's a paper published in 2000 by C. Julien, et al.
(Exhibit 2021 marked for identification.)
A Can you repeat that number for me, please?
Q Sure. 2021.
A 2021. Julien, 2000 -- I do have that document also.
Q Okay. Do you have Exhibit 2034? It is an article from 1958 by W.D. Johnston, et al.
(Exhibit 2034 marked for identification.)
A Yes, I do.
Q Okay. Do you have Exhibit 2035? It is a 2018 article by K. Banov, et al.
(Exhibit 2035 marked for identification.)
A Yes, I do.
Q Okay. And finally, do you have Exhibit 2036? It is a 1985 article by M.M. Thackeray, et al.
(Exhibit 2036 marked for identification.)

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A Yes, I do.
Q Okay. Do you have any other exhibits that I did not mention in front of you?
A My CV.
Q So that's Exhibit 2032; is that correct?
(Exhibit 2032 marked for identification.)
A 20 -- I have to check the number. That is correct.
Q Okay. Your declaration, Exhibit 2031, describes samples of certain lithium-ion battery cathode active materials that you prepared; is that correct?
(Exhibit 2031 marked for identification.)
A Can you repeat the question again?
Q Sure. Your declaration, Exhibit 2031, describes certain samples of lithium-ion battery cathode active materials that you prepared; is that correct?
A Assuming the number 2031 is my exhibit number, the declaration, then yes, that is my declaration. And in this declaration, I have included multiple materials I synthesized which

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was intended to be cathode materials for -- for lithium-ion batteries.
Q Okay. So your declaration describes active materials that you synthesized, correct?
A That is correct.
Q Did you have any assistance in synthesizing the materials described in your declaration?
A I did not.
Q You did these all yourself; is that correct?
A Yes, I did the synthesis all by myself.
Q Okay. Are there any parts of the analysis presented in your declaration that you did not do yourself?
A I did all the analysis of the results I obtained from my -- at least to my knowledge.
Q Did someone ask you to prepare the samples that you describe in your declaration?
MR. ZHOU: Objection. I'm just going to caution the witness not to reveal any privileged communications. And if you cannot answer this

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question without revealing privileged communications, I instruct you not to answer. But if you can, please do so.
A I was instructed by my lawyer Robert here to synthesize certain samples and Dr. Yan Yao was the person who instructed these experiments, these specific examples.
Q Okay. You mentioned a Dr. Yao; is that right?
A That's correct.
Q Is he the one that instructed you to prepare the specific samples that are described in your declaration?
A Dr. Yan Yao instructed through my lawyer to synthesize some of the materials described in my declaration.
Q Did Dr. Yao have any input into the various properties of the materials that you synthesized? For example, did he have any influence over the areal loading that you used for the various cathodes that you assembled?
MR. ZHOU: Objection, privilege. Similar

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to the -- similar to what I just said, I caution the witness not to reveal any privileged communications. And if you cannot answer this question without revealing privileged communications, I instruct you not to answer.
A I was instructed through my lawyer by Dr. Yan Yao to synthesize certain samples from Uemura or -- I do not -- I do not recall the exhibit number you call it, but also in Uemura there are certain mentions of areal loading and other things. And I do refer to those numbers to help make my decision what areal loading to use.
THE REPORTER: I'm sorry, I didn't catch the reference.
THE WITNESS: The reference -- I -- there's an exhibit number for that --
MR. SOMMER: The Uemura reference.
THE WITNESS: Yes. Uemura, I think the number is 1009. Please correct me if I'm wrong.
BY MR. SOMMER:
Q I believe you're correct, Dr. Liang.
A Again, I'm not familiar with this number

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please excuse me if I --
Q So what exactly were you asked to do for your analysis that you included in your declaration?
A I was not particularly asked to do certain analysis. What I was asked to do is to synthesize a couple of samples from Uemura and as Uemura described in their patent.
Q You also synthesized some samples from the Kajiyama reference; is that right?
A Trying to make sure what Kajiyama did. So in Kajiyama, they synthesized a layer compound, several layer compound through ion exchange method. And yes, I did synthesize materials based on Kajiyama.
Q Were you asked to do that synthesis as well or did you choose to do that?
MR. ZHOU: Objection. Again, to the extent you can answer this question without revealing privileged communications, please do so. But if you cannot, I instruct you not to answer.
A I was instructed by Dr. Yan Yao to

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synthesize this material so that we can -- what is the word I use? So that I can reproduce the battery as described as sample 2 in Uemura.
Q Do you have a copy of the Uemura -- or Uemura reference, Exhibit 1009, in front of you?
A That patent -- I do actually.
Q Okay. You had mentioned that Exhibit 1009, the Uemura reference, describes an areal loading; is that correct?
A They have information that could lead to areal loading. I do not remember if they have any specific mention of areal loading.
Q Can you show me what information Uemura has that could lead to the areal loading that was used in that reference?
A Sure. They have -- one second, please.
Q Certainly.
A For example, in paragraph -- or line 75 in Uemura, or page 5, they have mentioned they use a diameter of 12 millimeter which indicate a certain area of the electrodes they use. And in a separate item, for example number -- Figure 3,

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they also mention the weight of their positive electrode material, as they put it.
So if we combine these two information, assuming that they are referring to the same cathode, we can derive an areal loading, even though they may not have directly mentioned areal loading.
Q Did you perform that calculation in trying to recreate any of the examples from the Uemura reference?
A I did.
Q And you came up with an areal loading of approximately 13; is that right?
A I do not recall the number I derived from these calculations.
Q If you look at paragraph 25 on page 12 of your declaration, does that refresh your recollection?
A 25. In paragraph 25, I use a loading of about 13 milligram per centimeter square.
Q And you chose about 13 milligram per centimeter square to try to reproduce the samples

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of Uemura; is that correct?
A That is correct.
Q Why didn't you use Uemura's diameter of 12 millimeters?
A I didn't use the exact same size mentioned in Uemura because I do not think this is an important factor in evaluating the cathode material.
Q Why not?
A Battery electrodes come in various sizes and as long as these sizes are properly test in a cell, they should show identical performance.
Q Okay. So you used the mass from Uemura's Figure 3 and Uemura's diameter of 12 millimeters to calculate the areal loading, correct?
A I used numbers like these to assess the possible areal loading that Uemura has used. I do not necessarily use these number for my experiments.
Q You said -- sorry, go ahead.
A I do not deem these numbers used exactly by Uemura either. It's just a general gauge of

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the -- the configuration they have used.
Q So you used numbers like Uemura but you decided not to use Uemura's numbers; is that right?
A I have used those numbers as a reference.
Q And how did you use those numbers as a reference?
A For example, at the very beginning of this deposition, we talked about areal loading and if we can find out the possible range of areal loading used in Uemura, we can make sure that the areal loading we use would not be too large to underestimate any material reported in Uemura. If they would use a value of, say, 10 and I use a value that is about or less than 10, then all these areal loadings I use would not be too large. Because, in general, a areal -- a lower areal loading will lead to better performance and vice versa. If we use too large, for example, if I use 20 instead of 10 and it is possible but not necessarily that the performance of the material being evaluated will be underestimated in terms of

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performance and I try to avoid that.
Q Okay. So that was a -- a long technical answer so let me make sure I understood that.
Using a lower areal loading leads to better performance, correct?
A In general, yes.
Q And if your areal loading is too high, it may underestimate the performance of the material; is that correct?
MR. ZHOU: Objection, mischaracterize the witness testimony; scope.
A As stated, that there's a possibility that at those conditions, the performance of materials may be underestimated but that is not a necessity.
Q So how did you calculate the areal loading for Uemura's examples using Figure 3 and the 12 millimeter value you identified in paragraph 75?
A Earlier, I raised these numbers as examples how I may have derived these numbers. I do not recall what exact number I used for calculation of the areal loading.
Q But you did a calculation, correct?

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A I did.
Q And did you write that calculation down or did you do it in your head?
A I do not recall.
Q How do you go about determining the areal loading from the mass data in Figure 3 and a diameter? Is there an equation or an expression that you just plug values into?
A I'm assuming this is asking me to explain some of the terms I mentioned before. So totally for the sake of raising an example, using the diameter mentioned in for example number -- line number 75, 75, we can calculate the area of a circle with the diameter of 12 millimeter. I do not know what that area would be.
Let's say that area is 8. And we also have electrode material number in Figure 3. If we combine these two numbers, we just divide the number of weight by the number of area and we'll get the areal loading, assuming these numbers are referring to the same electrode.
Q So which column are you referring to for

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the electrode material number from Figure 3?
A There are many columns in Figure 3, let me count, 1, 2, 3, 4, 5, 6. For example, number 6, they have column full of number 15. And from the presentation of this table, it looks like the weight of the positive electrode material in these electrodes.
Q Okay. So your calculation to arrive at the areal loading for your reproduction of Uemura used 15 milligrams; is that right?
A I do not recall the specific numbers I used for Uemura. They use a lot of different numbers. But this is an example and I think it might be a fair example to represent Uemura as well.
Q So you don't recall if in determining the areal loading you relied on Uemura's Figure 3 indicating that the weight of the positive electrode material was 15 milligrams; is that fair?
MR. ZHOU: Objection --
A I --

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MR. ZHOU: Leonard, let me finish the objection.
Objection, mischaracterize the witness testimony.
Q Do you recall the question, sir?
A Yes. My answer would be still the same. I do not recall the specific numbers I used for my calculation.
Q And you don't recall whether you wrote that calculation down; is that correct?
A I do not recall if I wrote the calculation down.
Q But you did do a calculation and that calculation led you to create a positive electrode having a diameter of 7.14 millimeters and an areal loading of approximately 13 milligrams per centimeter squared; is that correct?
A That is correct.
Q Okay. So you had mentioned some discussion that you had had with counsel for RJ Tech. When you had those conversations, did you understand that counsel was sharing with you

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information from Dr. Yao?
MR. ZHOU: Objection. Dr. Liang, if you can answer this question without revealing the privileged communications, please do so. But if you cannot, I instruct you not to answer.
A As I said, I receive instructions from Dr. Yan Yao through my counsel.
Q Do you know Dr. Yao?
A I do.
Q And how do you know Dr. Yao?
A Dr. Yao has been a long-time colleague of mine.
Q Do you work with Dr. Yao in your job?
A I used to work with Dr. Yao in my job.
Q Which job was that?
A I was a post-doc at University of Houston. And in that period, Dr. Yao was my supervisor. And later, I was a research associate -- no, what is the title? I don't remember that. Sorry. Let me pull it up so -- yeah. Later, I was a faculty at University of Houston also. And at that time, I also collaborate with Dr. Yan Yao. And now I'm

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a CEO at LiBeyond, LLC and Dr. Yao and I are co-founders of this company.
Q So would it be fair to say you work with Dr. Yao today?
A I'm not sure that is an accurate description of the relationship between me and Dr. Yan Yao. We do -- we do share co-ownership of a company, but we do not work together day-to-day.
Q I notice from your CV that your current work experience, so from 2022 to the present, has been limited to -- I think you pronounced it LiBeyond?
A Yes.
Q L-I-B-E-Y-O-N-D?
A LiBeyond, LLC.
Q Yeah. Has that been your exclusive job since 2022?
A I have to refer to my CV to be specific about the timeline. So in 2022, I co-founded LiBeyond, LLC. As for exclusive job -- let me put it this way: So working at LiBeyond, LLC was not my exclusive job at the beginning of the founding

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of the company, but it is my exclusive job at this very moment.
Q So your work experience on your CV, that's an accurate representation of your work experience --
MR. ZHOU: Objection --
Q -- is that correct?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A May I hear the question again?
Q Is the work experience listed on your CV an accurate representation of your professional work experience?
A It is accurate to my knowledge.
Q Okay. There's not a job that you've held that is missing from your list; is that fair?
A There is no full-time job missing in my CV.
Q Okay. And so you and Dr. Yao are long-time colleagues, correct?
A That is correct.
Q Why didn't you just discuss the

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declaration and the testing that you did with Dr. Yao?
A I did not find a necessity to.
Q Why not?
A Because I didn't find it necessary.
Q Okay. Do you have a lot of respect for Dr. Yao?
A I have not formed an opinion on that.
Q Okay. Do you believe that Dr. Yao is an expert in the field of lithium-ion batteries?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that either, but I see why people would think that way.
Q And why is that?
A Well, like me, Dr. Yao is also well-known in the battery community, so I think that is enough reason for people to consider Dr. Yan Yao as an expert in battery field as well.
Q Now, you had mentioned that you and Dr. Yao are co-owners of LiBeyond; is that correct?
A We are both owners of LiBeyond, LLC.
Q Was LiBeyond retained to do the testing

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that is described in your declaration?
A Would you explain to me what does the word retained mean?
Q Yeah. Is there a contractual agreement whereby either counsel for the patent owner or RJ Tech, the patent owner, compensated you through LiBeyond for the testing that is described in your declaration?
A Okay. There are many specific terms in terms of contract and legal and I'm not sure if that is exactly like you said. But yes, as I pointed out in my declaration in paragraph 4, I was retained by counsel which I believe Robert is a representative of.
Q When you say you were retained by counsel, LiBeyond was not retained; is that correct?
A I'm not familiar with these terms, but I believe I was retained through LiBeyond. That was -- that was my understanding, but I could be wrong.
Q I'm sorry, there was an understanding among who?

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A That is my personal understanding.
Q Did you sign an agreement on behalf of LiBeyond related to the work that you put into this declaration?
A I do not recall.
Q Are you personally being paid for the work that you put into the declaration that you signed in this matter?
A Can you define paid personally?
Q Yeah. When you get paid for the work that you did on this, are you expecting a personal check written out to you or will the check be made out to LiBeyond?
A I would expect a payment to LiBeyond.
Q Okay. And in connection with LiBeyond, you share revenue for the money that LiBeyond makes with Dr. Yao; is that right?
A Ask that again.
Q Yeah. So let me back up. You and Dr. Yao co-own the business, correct?
A Correct.
Q Do you split profits with Dr. Yao as

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co-owners of the business?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that.
Q I don't think it's a matter of opinion.
Do you get paid by LiBeyond?
A I do get paid by LiBeyond.
Q Does Dr. Yao get paid --
A (Technical disruption).
Q I'm sorry, I missed the second half of that?
A I go get paid by LiBeyond for various works I perform at LiBeyond.
Q Does doctor -- does Dr. Yao get paid by LiBeyond?
MR. ZHOU: Objection, scope.
A That, I'm not sure.
Q As a co-owner of the company, you do not know if Dr. Yao makes any money from LiBeyond; is that correct?
MR. ZHOU: Objection, scope.
A I'm not sure about the payment structure in our company.

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Q Okay. Do you know whether Dr. Yao will make any money based on the work that you did and you put into this declaration?
MR. ZHOU: Objection, scope.
A I do not know.
Q It's possible that he could; is that correct?
MR. ZHOU: Objection, scope.
A I do not know.
Q Okay. You have co-authored a number of papers with Dr. Yao; is that correct?
A That is correct.
Q You are co-inventors on a number of patents with Dr. Yao; is that correct?
A That is correct.
Q Did you mention your relationship with Dr. Yao in your declaration?
A I do not recall I described the relationship in specific.
Q Why not?
A I think the way I put in my declaration, it is obvious the relationship, what relationship

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I have with Dr. Yan Yao. And I do not believe that such relationship is of its own writing.
Q What do you mean you do not believe such relationship is of its own writing?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A So if we go through my declaration in paragraph 10, I wrote that I joined Cullen College of Engineering as a post-doc working with Dr. Yan Yao. That was in 2012. So I think the employee/employer relationship, that is probably not the right term to describe it. So the work relationship established in this sentence is already enough to describe the relationship between me and Dr. Yan Yao.
In a separate paragraph, I think -- okay. This is not as obvious, but in line 12, I mention that in 2021, I co-founded LiBeyond, LLC. I didn't specifically mention another co-founder was Dr. Yan Yao. But the founder information of LiBeyond, LLC is public information. So this, again, explain the relationship between me and Dr.

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Yan Yao.
And as I said, Dr. Yan Yao has been a coworker with me as implied in line 10 and also a co-owner with the business as described in line 12. I do not think any additional description is justified because these already fully disclose my relationship with Dr. Yan Yao.
Q You have mentioned now line 12. I want to make sure I understand what you're referring to. Which paragraph number are you referring to?
A When I said line 12, I mean paragraph 12. I'm not sure which legal term you use.
Q Okay.
A Number 12 on page 4.
Q Okay.
A Page 3 to 4.
Q So you believe the nature of your relationship with Dr. Yao is obvious based on what you put in your declaration; is that right?
A That is correct.
Q Are you an expert in synthesizing inorganic battery cathode materials?

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A It would be fair to say so.
Q Okay. What is the nature of your experience in synthesizing inorganic battery materials?
A I worked on the synthesis material characterization, electrochemical characterization, and interpretation of these characterizations. And I publish paper on these topics.
Q So you said you published papers, at least in part you'd publish papers on synthesizing inorganic battery materials; is that correct?
A That is correct.
Q Are the papers listed in your CV?
A Yes. They are.
Q Can you give me an example of a paper that describes your work synthesizing inorganic battery materials?
A Absolutely. So for example, I don't know what is the page number on your side, but there's a list of publications where number 55 mention a -- there's a paper, Enhancing sodium-ion battery

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with inter-layer expanded, molybdenum sulfide PEO nanocomposites.

Molybdenum sulfide is an inorganic material. And then but this is one of the examples, but there are several more examples if you would like to see all of them I would like to, but it may take a while.

Q You said there's several more?

A Yes.

Q How many more do you think there are?

A I don't have an opinion on that.

Q Okay. But the -- the papers that mention molybdenum disulfide would be examples; is that correct?

A That is correct.

Q So for example, 54, your publication number 54?

A 54 is a characterization of molybdenum disulfide.

Q Okay. Other than molybdenum disulfide, what other types of inorganic battery materials have you synthesized in connection with your work?

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A In connection with my work. There are also vanadium-based compound as you see in 56 and 55, even though they are not exactly the same type. 56 is a vanadium-based oxide. 58 is a so-called polyanium type, but they are both vanadium ones, compounds.

And then in, let me see -- number 61, mentions a nickel manganese transition metal oxide. That is for lithium-ion.

Yeah, with that going through too much time to find all the examples, I just want to mention that these are where the compounds are named specifically in the titles so that you can see clearly, but there are also synthesis that are not reflected in the title so I will not go into those examples.

Q Okay. As part of the work in synthesizing inorganic battery materials that you've done, have you ever attempted to synthesize layered inorganic materials as part of your work?

A Yes, I did.

Q Can you give me an example of that?

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A For example, molybdenum disulfide is a layer compound.

Q Besides the molybdenum disulfide, do you have any other examples that you can provide?

A I have also worked on titanium disulfide.

Q Any others?

A I do not recall.

Q Okay. So beyond your experience with molybdenum disulfide and titanium disulfide, you don't recall trying to synthesize any other layered active materials for batteries; is that fair?

A That is correct.

Q Okay.

MR. SOMMER: We've been going about an hour, if now is a good time for a short break. I can keep going if you prefer.

THE WITNESS: I think we can take like a ten-minute break.

MR. SOMMER: That's fine by me.

THE VIDEOGRAPHER: Going off the record. The time is 10 o'clock a.m.

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(Whereupon a break was had.)

THE VIDEOGRAPHER: We are back on the record. The time is 10:11 a.m.

BY MR. SOMMER:

Q Sir, do you have any prior experience, and my prior, I mean before you wrote the declaration and did the work described in the declaration, synthesizing lithium manganese dioxide?

A No, I didn't.

Q LiBeyond is focused on using magnesium in anodes; is that correct?

A That would be one of our technologies.

Q Is there another technology?

A Yes. We also develop all solid-state lithium batteries.

Q Okay. And do you do that on a contract basis?

A I'm not sure --

MR. ZHOU: Objection, form.

Q Okay. You mention that you do development of, I think you said, solid-state lithium, is that right, batteries?

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A That is also one of our technologies.
Q Okay. Do you do that work on behalf of other companies, I guess is the question?
A We do not do that for -- on behalf of other companies.
Q Okay. Before this case, had LiBeyond been hired to synthesize inorganic cathode materials?
MR. ZHOU: Objection, scope.
A Not to my knowledge.
Q Before this case, have you ever tried to make layered lithium manganese complexes?
A What do you mean by lithium manganese complexes?
Q So lithium manganese blended with other metals such as cobalt?
A Okay. May I hear the full question again?
Q Sure. Before this case and the declaration and the work that you described in it, had you ever tried to make layered lithium manganese complexes?
A I have not tried to make layered complexes based on only lithium and manganese as the metal

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elements.
Q Had you tried to make layered -- layered complexes based on lithium, manganese, and other metals?
A I've not tried to make complexes -- layered complexes based on lithium, manganese, and other metals. Not that I recall.
Q Okay. Sir, were you provided with any -- and this is a yes-or-no question.
Were you provided with any guidance about the legal standards to apply when you rendered the opinions that are in your declaration?
A May I hear the question again?
Q Sure. Were you provided with any guidance about legal standards to apply when you rendered the opinions in your declaration? And I -- I only need a yes or a no.
MR. ZHOU: Yeah. I caution the witness not to reveal any privileged communications.
A In your question, you mention something -- I didn't catch the phrase you used.
Q Yeah. So let me -- let me repeat the

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question once more and then maybe you can identify the phrase that you're struggling with.
Were you provided with any guidance about legal standards to apply when you provided the opinions in your declaration?
A You mention a term legal -- legal something.
Q Standards?
A Legal standard. I'm not for sure what that means.
Q Okay. Were you provided any instructions about the law?
A For example?
Q The criteria for determining who a person of ordinary skill in the art is?
A I was not provided that information.
Q Okay. Do you render any opinion about the skills possessed by a person of ordinary skill in the art?
A I do not recall that.
Q Okay. Do you know what skills would have been possessed by a person of ordinary skill in

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the art in September of 2001?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that.
Q So in paragraph 27 of your declaration -- let's start with actually paragraph 23.
In paragraph 23, you have a sentence that reads: The patterns also demonstrate to one of ordinary skill that the three samples do not possess a layered structure as described in Uemura.
Have I read that correctly?
A My declaration says the patterns also demonstrate one of ordinary skill that the three samples do not possess a layered structure as described in Uemura.
Q And you did not express an opinion on who one of ordinary skill is, correct?
A This is a term that I generally use when filing patents and I use the same term here. But as far as the legal definition of this term, that I don't know.
Q What do you mean you use this term when

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you file patents?
A As discussed earlier in this declaration, I do have multiple patents, some even in the U.S. and we do use terms like this.
Q So you include terms like this in your own patent work; is that correct?
A That is correct.
Q But you don't have an opinion on what a person of ordinary skill and what skill set that person would possess; is that correct?
MR. ZHOU: Objection, scope.
A I do not have -- I have not formed an opinion on what the term means legally.
Q Have you formed an opinion on what the term means in the context of the '641 patent?
MR. ZHOU: Objection, scope.
A '641, I'm not sure what that is.
Q Okay. Did anyone provide you any instructions on the level of skill that a person of ordinary skill would have for the purposes of your analysis?
A May I hear the question again?

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Q Yeah. Did anyone provide you with the description of the set of skills that a person of ordinary skill would have in --
MR. ZHOU: Objection, form.
Q -- connection with your work on this case?
MR. ZHOU: Yeah. I caution the witness not to reveal any privileged communications.
A That is quite a complicated question. May I hear -- I may have to hear it again.
Q Sure. Were you instructed to apply a particular understanding of a person of ordinary skill when you rendered your opinions?
A There was a bunch of terms that I'm not familiar with, so I would have to venture to answer that the answer is no.
Q Okay. What terms are you not familiar with? I want to make sure you understand the question.
A How about you repeat all those terms that were in your question.
Q Okay. Were you instructed to apply a particular understanding of a person of ordinary skill when you rendered your opinions?
A The opinions in my declaration are my own.
Q Okay. And did you make any effort to put yourself in the mindset of a person of ordinary skill in September of 2001 --
MR. ZHOU: Objection --
Q -- when you rendered your opinions?
MR. ZHOU: -- scope.
A That's a very hypothetical question. I have not formed an opinion on the answer of this question.
Q What do you mean it's a hypothetical question?
A You're referring to a very specific mind process and I'm not sure exactly what that means in practice.
Q Okay. So when you say, for example, in paragraph 27 -- strike that. I'll rephrase the question.
When you refer to a person of ordinary skill in paragraph 27 of your declaration, what do you mean?

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A When I said a person of ordinary skill in paragraph 27 in my declaration, I refer to a person who are like me, also have been working on the battery field for some day and know the basics of batteries. But again, I do not have an opinion of the legal implication of this term, if it exists.
Q Okay. So when you use the phrase "a person of ordinary skill" in your declaration, you believe that person would have your skill set; is that right?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A When I wrote "person of ordinary skill," I expect the people to have basic knowledge of battery-making and analysis.
Q What do you mean by basic knowledge?
A For example, the working principle of a battery and related knowledge of the synthesis, characterization, and analysis of batteries.
Q How much experience with the working principles of batteries, related knowledge of the

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synthesis, characterization, and analysis of batteries would one need to be of ordinary skill in this art?

MR. ZHOU: Objection, scope.

A I have not formed an opinion on that.

Q And you have no opinion on that as you sit here today; is that correct?

A That is correct.

Q And there's no opinion expressed in your declaration on that subject; is that correct?

A I didn't define the term "person of ordinary skill" in my declaration.

Q And you weren't instructed to provide any -- to rely on any particular definition of a person of ordinary skill, correct?

A I was not instructed on what should be the definition of a person of -- a person of ordinary skill.

Q Sir, how old were you in September of 2001?

A Let me bring up my calculator. If my calculation is correct, I was 16.

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Q Did you have a bachelor's degree in September of 2001?

A If I remember correctly, I did not.

Q When you were 16, had you been synthesizing any battery materials for lithium-ion batteries?

A Not to my knowledge.

Q Did you have any expertise in lithium-ion cells or batteries in September of 2001?

A I do not recall.

Q Are you familiar with the abbreviation XRD?

A Yes.

Q What does XRD stand for?

A XRD stands for x-ray diffraction, if I remember correctly. I have this information in my declaration if you would like to go through it. Please go ahead with your question.

Q So XRD stands for x-ray diffraction, correct?

A Yes.

Q And what is x-ray diffraction used for in your field?

A It is usually used for determination of the phase of a material, among other purposes.

Q And did you use XRD to determine the phase of materials that you synthesized in connection with your declaration?

A Yes, I did.

Q Did you use XRD for any purpose other than trying to evaluate the phase of the materials that you synthesized in connection with your declaration?

A No. I did not.

Q How accurate is XRD?

A XRD gives patterns of pings and positions and other stuff and let us compare with other material and deduce the phase of the material in question. I'm not comfortable with using accuracy to describe XRD.

Q Does XRD have a particular spatial resolution?

MR. ZHOU: Objection, scope.

A What do you mean by spatial resolution?

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Q Let me see if I can get at this a different way.

Are there ever instances in which two peaks in the XRD data are very close together?

MR. ZHOU: Objection, scope.

A Depending on the material, it is possible but not always.

Q Okay. And is it possible that two XRD peaks can be so close together that they can be difficult to distinguish from each other?

MR. ZHOU: Objection, scope.

A I have not formed an opinion on that.

Q Have you ever seen a situation in your experience where two XRD peaks are so close together you could not distinguish them from each other?

MR. ZHOU: Objection, scope.

A Not that I recall.

Q What type of XRD equipment did you use in the testing described in your declaration?

A May I hear the question again?

Q What type of XRD equipment did you use in

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the testing described in your declaration?
A It's a -- what are the types available?
Q Is it a particular machine that you used?
A It was a machine.
Q Okay. Who makes this machine?
A The brand is Rigaku.
Q Can you spell that for me, please?
A If I remember correctly, it is R-I-G-A-K-U.
Q Is the XRD equipment, does that have a model number for the one that you used?
A It does, but I do not recall.
Q Okay. Does the XRD equipment that you used to conduct the testing described in your declaration able to distinguish peaks located a half a degree apart?
A I have not formed an opinion on that.
Q Did you investigate that when you formulated your opinions in your declaration?
A I did not explore that possibility.
Q In paragraph 22 of your declaration, you provide a plot of x-ray diffraction data for the

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samples that you created, correct?
A I believe I provided XRD patterns in paragraph number 22.
Q And these are for your efforts to reproduce certain examples from the Uemura patent publication; is that right?
A Patterns were collected in connection to reproducing examples from Uemura.
Q Can you walk me through the steps that you undertook to prepare the data that you have used to create the plot at the end of paragraph 22 of your declaration?
A Absolutely. So after synthesis, I have obtained a powder -- powders of the samples. And these samples were compacted into -- I do not know how you describe it. I put these into a holder, a sample holder specifically designed for XR -- XRD machines and compact the powder into a solid block, I believe maybe that is -- if that is the right term to use.
And I insert the sample holder into the XRD machine for which the sample holders were

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designed for and set up the parameters I need, for example, the scan angles and scan rate and the other stuff. And hit start and we -- we will be provided a -- provided files of patterns. And that is the whole process roughly.
Q So did you set the scan angle for the data that you used to create the patterns at the end of paragraph 22 of your declaration? You set that between about 18 and 80?
A Yes.
Q What did you set the scan rate at?
A I do not recall.
Q Do you know how you selected the scan rate?
A Yes. I selected the scan rate based on my experience on similar materials.
Q And which similar materials did you use as the basis for this experience that you drew upon? Let me strike the question. It was a complicated question.
You mentioned similar materials in your prior answer. What similar materials?

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A Materials that we use for various batteries that is like the default setting for most materials. So how it works is that we usually use these standard scan rate unless there is some special requirement of a material.
Q Okay. So the scan rate that you selected is the one that you used for all lithium battery materials that you perform XRD on; is that fair?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A The scan rate I used is very generally applicable for various of -- various materials.
Q Did you use the same scan rate for all the testing that you reported in your declaration?
A I used the same scan rate for all the materials -- for all the XRD measurements described in my declaration.
Q Okay. Do you agree with me that if two compounds have similar XRD patterns, their crystal structures should be similar too?
A It is likely.
Q You said likely. Is there any way to tell

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for certain?
A Usually when people want to tell for certain, they have to perform additional characterizations.
Q What additional characterizations would need to be performed?
A There are many possible techniques. One is to record -- no, to try to synthesize very high-quality material and use very high-resolution XRD machines to collect patterns with very high quality spectra and use refinement to -- to detail the structure of these materials. But to do that, it has requirements on both the sample and the machine and possibly also the people who do these analysis.
Q Okay. Did you attempt to do that type of analysis on the samples you created?
MR. ZHOU: Objection, scope.
A I did not find it necessary.
Q So you didn't attempt to use a high-quality XRD machine, as you've characterized it; is that correct?

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I'm sorry, let me rephrase the question. I think I mischaracterized what you said.
You did not attempt to use a very high-resolution XRD machine when conducting the testing reported in your declaration, correct?
MR. ZHOU: Objection, form and scope.
A I did not find it necessary.
Q Did you attempt to create a very high-quality material to conduct the testing described in your declaration?
MR. ZHOU: Objection, form and scope.
A I attempted to replicate the experiment described in Uemura.
Q Okay. Would you say that you attempted to create a high-quality material for the purposes of ascertaining its structure when you tried to replicate the examples from Uemura?
A Can you point me to where I said this?
Q No. I'm asking you if you did.
A May I hear the question again?
Q Sure. Would you say that you attempted to create a high-quality material for the purposes of ascertaining its structure when you tried to replicate the examples from Uemura?
MR. ZHOU: Objection, form.
A I attempted to reproduce the synthesis described in Uemura and obtain a sample of comparable quality as described in Uemura.
Q Okay. Would you agree that the XRD data in the plot at the end of paragraph 22 of your declaration shows that each sample has different crystallographic properties?
MR. ZHOU: Objection, form.
A I think these spectra have similarities and also differences.
Q The similarities and differences, what do they tell you about the structure of the material you produced?
A From this set of spectra at the end of paragraph 22 from -- based on my own analysis, I believe all these three samples have rock salt structure most likely and less likely -- or almost equally likely spinel structure as also explained in page 10 or at the end of paragraph 24. That is what I can tell from these spectra.
Q Okay. The -- the spectra in the plot at the end of paragraph 22 can indicate the structure of the material that you synthesized, correct?
A I think these spectra reflect the phase of these materials.
Q And by phase, you mean the crystalline structure of the material, correct?
A That is correct.
Q Okay. You would agree with me that the crystalline structure of each of the examples that you produced is not identical, correct?
A May I hear the question again?
Q Do you agree with me that the crystalline structure of each of the examples that you produced and -- and plotted in paragraph 22 of your declaration are not identical, correct?
A According to our definition of example, I have shown the XRD spectra of three different samples and these three samples did not show identical XRD spectra.
Q Based on the lack of an identical XRD

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spectra, do you believe that the structure of the three examples that you tested are not the same?
MR. ZHOU: Objection, form.
A Based on the XRD patterns for these three samples presented at the end of paragraph 22, I believe the crystal structure of these three samples have similarities and also differences.
Q What are the similarities that you've observed?
A These three samples seem to share some peaks which indicated that they may have -- they may share phase reflected from these peaks.
Q And what are the differences that you noted?
A Some of the samples show additional peaks to some other examples, and also even the peaks that they do share, they have different strengths in these peaks which I -- which indicate that they also have differences in crystalline structure.
Q Is it still your belief despite these differences that they all reflect rock salt variations of the materials that you created; is

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that right?
A Based on my analysis, these structures could be rock salt or spinel or a mixture of them.
Q You said earlier that it's most likely rock salt; is that right?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A As described in my declaration, both rock salt and spinel are possible structures for these samples.
Q But not a layered structure; is that right?
A Layered structure is not a most likely outcome from the analysis of these spectra.
Q You would agree with me that the samples that you made with .83 and .67 lithium have more pronounced peaks at about 18 degrees 2 theta than the samples with .67 lithium; is that correct?
A That is correct.
Q Does that indicate anything to you?
A That indicate a difference in crystal structure.

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Q Did you do anything to try to gain an understanding of what that difference in crystal structure reflects?
MR. ZHOU: Objection, scope.
A The rise of the peak, to me, it means it may indicate a formation of a different phase in these materials which reduced the phase purity of these materials.
Q And do you know how to characterize the different phase that you see forming in these materials?
A It is possible to characterize individual phases in one compound, but these compounds have to -- these phases in these compounds should be highly crystalline and with that, we can start characterization.
Q I need to make sure I understood that answer.
So are you saying that because these compounds -- strike that.
Is it correct that individual compounds, so one compound, is easier to characterize the

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phase in than characterizing the phases in materials with multiple compounds in them?
MR. ZHOU: Objection, mischaracterize the witness testimony.
A I said that to further characterize the structure of compounds, they need to have high crystallinity. It doesn't matter if it's a single component or multiple.
Q So high crystallinity is important to be able to accurately characterize the phase of the composition; is that correct?
A That is correct.
Q Do you believe that the materials you've produced had high crystallinity?
MR. ZHOU: Objection, scope.
A Probably not.
Q Okay. And why do you say that?
A Crystallinity can be determined by the peak width and also strength of the refraction peaks in an XRD pattern. And to characterize -- you know, to qualify as high crystallinity, we do need to see sharp peaks and strong peaks well

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defined.
And I do not think that the pattern observed from this sample qualify as what I just said, the standards of high quality -- no high crystallinity materials.
Q Okay. And would you say that none of the three samples that you've provided data for in paragraph 23 have high crystallinity based on your analysis?
MR. ZHOU: Objection, scope.
A May I hear the question again?
Q Sure. Would you say -- I'll rephrase it. I don't want to confuse you, but I'm going to rephrase the question.
Do any of the three samples reflected in the plot at the end of paragraph 22 of your declaration exhibit high crystallinity?
A They do not appear as high crystallinity to me.
Q Okay. Uemura's examples 1 through 17 are not lithium cobalt oxide; is that correct?
A Let me pull Uemura up. Examples 1 through

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17 in Uemura are oxides of lithium and transition metals.
Q Are any examples lithium cobalt oxide?
A From example 1 through example 17, there is no compound in -- no compounds that have only lithium cobalt and oxygen. If that is your definition of lithium cobalt oxide, then no, there is no lithium cobalt oxide.
Q Is a compound that includes lithium, cobalt, and oxygen but not any other metals the typical definition of lithium cobalt oxide in the field?
MR. ZHOU: Objection, form.
A I have not formed an opinion on that.
Q Okay. You have produced a series of plots after paragraph 24 of your declaration; is that correct?
A That is correct.
Q So there are two pairs of plots. There's a top pair and a bottom pair; is that correct?
A If you are talking about page 10, then yes.

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Q I am. So the top pair of plots compares one of the samples that you created from Uemura with some reference for rock salt; is that right?
A That is correct.
Q Where did the reference material plot come from?
A It came from one of -- I believe one of the exhibits I cited. You want on the so-called top pair at page 10, the rock salt lithium .210, cobalt .790, if I'm reading it correctly, oxygen is coming from Exhibit 2034, a paper published in 1958 authored by Johnston.
Q Can you point me to where that data comes from in the Johnston reference, Exhibit 2034?
A Let me pull up that paper, please.
Okay. So if you have access to Exhibit 2034, on page 4 of that paper, there's a table that spans the -- almost the whole page where the some -- the -- the number of the lithium cobalt oxygen 2 has all these reflection peaks. They have the position and also the intensity of these compounds. And that is for -- let me see if

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this is the data that I'm referring to.
So sample listed in this so-called top pair, the lithium .210 appears in page 5 of Johnston. There's a table called Table 3, and at the very last entry there's a compound that is lithium .21 and cobalt .79. This is the same compound listed in my declaration in the top pair, the rock salt structure.
As for the base designation of this compound, it appears on page 6 of Johnston. There's just a title (c) Phase diagram, where they discuss that when the lithium X cobalt 1 minus X oxygen, which is the line three in the paragraph Phase diagram, they discuss that in the range of X between 0 and .5, the phase have the rock salt structure. This is their designation of this, of the phase of this compound.
As for this spectra showed in the top pair for the rock salt structure, I put it in that database deposit by -- deposit from this Johnston paper. I assume this is a visualization of the data presented in this paper, for example, in

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Table 2 where they list their position and height of the peaks and they have further adjustments in following figures.

Does that answer your question?

Q I believe so. So is the bottom plot from the top pair on page 10 of your declaration from a database?

A The visualization of the plot is from a database.

Q And where -- where is that database?

A These are generally available. I think it is some open source international crystal structure database. I don't recall the name, but the number of this specific spectra is listed in the graph as well. The number is 75-540. If you search these number together with the compound name, you may be able to find it in open source database.

Q So you went to an open source database and pulled the XRD plot for lithium cobalt oxide as described in the annotation on the plot for 75-540; is that right?

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A That is correct.

Q Okay. And you believe this to be a visualization of the data contained on page 4 of Exhibit 2034; is that correct?

MR. ZHOU: Objection, mischaracterize witness testimony.

A The graph show in the bottom of the top pair is data coming from this Johnston paper. As for how they arrive in this pattern, I would have to speculate.

Q How do you know that this is the data coming from the Johnston paper, Exhibit 2034?

A If you go to the database, every single curve of XRD they list there will have the source material.

Q And is that how you located the Johnston paper to cite in your declaration?

A That is correct.

Q Okay. You had pointed me to the section on page 6 of the Johnston reference under phase diagram; is that fair?

A It's fair to say.

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Q Okay. That first sentence talks about the characterization of lithium cobalt oxide phase, right?

A In the first sentence, they talk about characterization of lithium cobalt oxide 2 phase, oxygen 2 phase.

Q And it says that it became possible to examine the phase diagram of the lithium cobalt oxide system in the range of 0 to 0.5 for X; is that right?

A I believe that is accurate paraphrase of the paper.

Q What does X refer to?

A According to the equation in this paper, X refers to the lithium amount in this compound system.

Q And -- and according to the Johnston paper, it was possible to examine the phase diagram up to an amount of lithium of 0.5, correct?

A In the range of 0 -- between 0 and.5.

Q None of the samples that you prepared

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based on Uemura had a lithium content of less than or equal to .5, correct?

A None of the samples I synthesized have a lithium -- okay. Each number is relative, so to define it more accurately, none of the compounds in the samples I synthesized have a relative ratio of lithium to manganese plus cobalt of less than .5.

Q So why did you select this example to use to compare with example 1 from Uemura?

A Because it's a very similar system and the XRD pattern from this compound system match very well with the sample I presented in the upper part of the top pair at page 2.

Q Did you consider any other plots from the open source database for rock salt in connection with your analysis?

MR. ZHOU: Objection, scope.

A I may have, but I do not remember exactly.

Q Why does Johnston say that it was possible to examine the phase diagram of the lithium cobalt oxide system only up to .5 lithium?

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A I have not formed an opinion on that.
Q Okay. So you -- it's fair to say that as you sit here today, you do not know why Johnston says it became possible to examine the phase diagram of the lithium cobalt oxide system in the range from 0 to .5, correct?
A I'm not ready to speculate a thought process that Johnston have when writing this particular paragraph, but I would like to also point to the fact that the material system that they presented in this paper never have a lithium, at least in their formula the lithium number never goes beyond .5.
Q But you're not sure why that is; is that fair?
A I did not try to speculate their specific use of number.
Q Okay. Why didn't you plot Uemura's other two examples that you created against the rock salt example?
A I would have to speculate that you are referring to the graph I presented at the end of

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paragraph 22 where I show three samples where the three samples have both similarities and differences. And as I mentioned before, in some of the samples, some new phase seems to be emerging in addition to the -- the spectra show in lithium .67, which points to a decrease in phase purity.
But all these samples do share the same sets of XRD piece was presented in lithium .67, the top sample presented in the figure at the end of number -- paragraph 22. So I pick the sample that showed the best phase purity to facilitate and manifest of the phase.
That's the reason why I chose lithium .67 to compare it with other examples I can find in databases.
Q Okay. So the bottom pair of plots, where did you get the plot for lithium cobalt oxide 1.47 cobalt 3 oxide 4? So let me -- let me rephrase that.
So you -- you've got a plot for a material 39-846; is that right?

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A The number for this data, the PDF number for this data is 39-846.
Q Where did this data come from?
A This should be coming from Exhibit 2036, a paper published by Thackeray, et al., in 1985.
Q And did you obtain the XRD plot at the bottom of the second set of plots from the same database you got the first set from?
A I got this bottom half of the graph from a database.
Q Is it from the same database you got the other data from?
A I have not formed an opinion on that.
Q So it's not a matter of opinion.
Did you grab the data from the same source that you --
A You're asking --
Q -- that you did the top pair?
A You're asking me to -- to define if the database for the two graphs are the same and I think that would be an opinion because I have not done research on their source of these particular

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graphs, so I cannot answer your question.
Q What do you mean you haven't done research into the source of the graphs? Do you not know where they came from?
A These are all coming from databases but I'm not sure if they are the same database.
Q Did you personally get the data for the bottom sets of plots in both the top and the bottom -- strike that.
You have two plots here that you've gotten from databases, correct --
A That is correct.
Q -- on page 10 of your declaration?
Did you get that data yourself?
A I did.
Q Where did you get it from?
A I get them from databases.
Q Okay. Two databases?
A How -- this is how it works. So I use a software to help me analyze these XRD data and these software help me integrate multiple databases. And the software can pull data from

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these databases and I'm not sure if these particular spectra are pulled from the same database.

Q Okay. What is the name of this software?

A Many software can do this. The specific software I used, let me see I can find it. The particular software I use is called Search-match, but there are many other variant -- very -- very different software that can do the same thing.

Q Okay. So you fed the XRD data from Uemura's example 1 that you created into this software and it provided you with candidate XRD plots from the literature; is that right?

A That is correct.

Q How many candidates were returned based on the search you ran?

MR. ZHOU: Objection, scope.

A I did not try to count the number of candidates and so I do not have an answer to you, sir.

Q Was it more than two?

MR. ZHOU: Objection, scope.

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A It was probably more than 100.

Q More than 100. So how did you go about selecting the two that you included in your declaration from the around or more than 100 results returned by your software?

MR. ZHOU: Objection, scope.

A As -- as this part in my declaration, the general process of XRD analysis is to look at their peak position, intensity, width, and shape of the peaks from the diffraction pattern. So I perform a general practice in the analysis of these samples.

And based on information of the candidates provided by the software, I compared the position, intensity, width, and shape of peaks from the samples I obtained according to Uemura and collected from our XRD machine. And those appear in the candidates and I make my judgment of which ones are the best candidates, I would say, to compare these structures to.

Q So the software returned perhaps more than 100 potential candidates. You reviewed them all and determined which ones fit the best; is that right?

MR. ZHOU: Objection, mischaracterize witness testimony.

A I review a large number of candidates and compared them with the spectra I collected with the sample I synthesized according to Uemura and decide which one showed the best similarity -- similarity in terms of position, intensity, width, and shape in the XRD diffraction pattern.

Q Okay. So you know, to get to the -- the nut of my question here, you picked the ones that you thought were the best matches to what you actually synthesized from Uemura; is that correct?

A I picked the candidates that I believed to be the most similar to the one obtained from the sample synthesized according to Uemura.

Q On page 11 of your declaration, you have another series of XRD patterns, correct?

A That is correct.

Q The top pattern is example 1 from Uemura, correct?

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A That is correct.

Q What is the bottom pattern?

A The bottom pattern is a layered structure oxide of lithium, cobalt, and manganese.

Q Where did you get the data for that plot from?

A I measured XRD pattern myself.

Q What sample did you use to measure that XRD pattern?

A I used a sample I synthesized myself.

Q Is that sample described anywhere in your declaration?

A Yes. Same sample is also shown at page 19.

Q Is this the sample that you prepared using Kajiyama?

A That is correct.

Q So the methodology that you used to prepare the sample in the bottom plot on page 11 of your declaration is described later in your declaration; is that correct?

A That is correct.

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Q Why didn't you use the same technique of going to a database and finding reference plots for layered lithium cobalt manganese oxide?
A Can you ask the question again?
Q Yeah. Why didn't you use the same process that you used for the other plots and use the database to find reference plots for lithium cobalt manganese oxide?
A I do not recall --
MR. ZHOU: Objection --
A -- seeing this anywhere in my declaration. Would you like me -- would you like to point me to that?
Q Okay. So -- let me back up here.
For the plots and the comparison you did on page 10, you used software that pulled results from a database, correct?
A That is correct.
Q And for the plot that you have at the top of page 11, you did not pull results from a database using your software, correct?
A The plot in page 11 serve a different

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purpose from those two shown in page 10. The two in page 10 is trying to find structures that match the structure of the sample prepared according to Uemura as -- as well as possible. And the graph presented in 11 is to use an actual layered structure to compare with the sample prepared according to Uemura instead of trying to match the structure of the sample prepared according to Uemura.
That is why these comparison do not require a software.
Q Did you use your software to search for an XRD plot of layered lithium cobalt manganese oxide and choose not to include it in your declaration?
MR. ZHOU: Objection, form.
A I do not recall if I tried that, but I do not find that necessary because the standard curve was already reported in another literature which is, I believe, Kajiyama, they have reported their spectra in their paper. And if I'm synthesizing a material based on a paper, I would naturally just compared the XRD I collected from the synthesized

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sample with the spectra reported in the same reference. Same way a person who reproduce Johnston sample will compare their spectra directly with Johnston's instead of going through a database.
Q Okay. And you believe that the XRD spectra of the layered material in the bottom portion of a plot on page 11 is similar to that reported in Kajiyama; is that correct?
A That is correct.
MR. ZHOU: Objection, form.
Q You would agree with me that the Kajiyama material has a defined peak for layered structure around 18 degrees; is that right?
A May I hear the question again?
Q You would agree with me that the layered structure you produced based on Kajiyama has a defined peak around 18 degrees; is that correct?
A A sample I prepare according to Kajiyama does show an XRD diffraction peak at about 18 degree.
Q And the sample that you prepared according

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to Uemura, example 3 and 4, have that same well-defined peak at the same place, correct?
A May I hear the question again?
Q The sample that you prepared from Uemura, example 3 and 4, have the same well-defined peak around 18 degrees, correct?
MR. ZHOU: Objection, form.
A The sample I synthesized according to Uemura example 3 and 4 does show a peak at about 18 degree.
Q And you didn't do a comparison between examples 3 and 4 from Uemura and the layered material you produced according to Kajiyama; is that correct?
MR. ZHOU: Objection, mischaracterize witness testimony.
A In my declaration, I did not put a sample of synthesized according to Uemura example 3 and 4 in the same figure as did one produced from synthesized according to Kajiyama.
Q Going back to the bottom plot on page 10 of your declaration, the spinel, where did the

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data come from in the Thackeray paper to create the plot at the bottom of page 10?

A Let me pull up the Thackeray paper.

So in the Thackeray paper on page 179, there's a Table 3b which is the table towards the center of the page where they have reported the XRD data for lithium 1.47 cobalt 3 oxygen 4, where they listed all the peak position and peak intensity.

Q Okay. You believe that that is where the data for the plot at the bottom of page 10 came from; is that right? Let me rephrase the question, just to be precise.

That is where you believe the data for the plot at the bottom of page 10 of your declaration comes from, correct?

A It's my understanding that the plot pulled from the database for this compound is based on data -- the data presented in Table 3b in Thackeray.

Q And where do the angles come from out of Table 3b?

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A I do not know exactly what their position is coming from, but based on my expertise in XRD analysis, these can be obtained from the hkl parameters. These parameters could appear in the same position across different samples in system of compounds. And in this same -- same paper, they have reported the position of these peaks according -- correlating to certain hkl information.

So based on this an XRD pattern could be constructed.

Q Okay. But you're not sure how that's done from Figure 3b; is that correct?

MR. ZHOU: Objection, mischaracterize the witness testimony.

A It is my understanding that it is based on the data presented in Table 3b in connection to other data presented in Thackeray. That is the way how the spectra in the database is generated.

Q But you can't step me through step by step about how the plot at the bottom of page 10 of your declaration is created based on the Thackeray paper; is that correct?

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A May I hear the question again?

Q Yeah. Can you step my through step by step how the data from the Thackeray paper results in the plot at the bottom of page 10?

MR. ZHOU: Objection, form.

A This is a question about the data deposit -- the depository from a published work to the database, and I'm not familiar with that process.

Q Okay. And you don't know the name of the database that this came from; is that correct, the plot at the bottom of page 10 of your declaration?

A I don't recall the name for the database.

Q Okay.

MR. ZHOU: Counsel, we have been going on for about an hour and 30 minutes. Do you think it's a good time for a break?

MR. SOMMER: Yeah. This is a fine time for a break.

THE VIDEOGRAPHER: Great. We're going off the record. The time is 11:43 a.m.

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(Whereupon a break was had.)

THE VIDEOGRAPHER: We are back on the record. The time is 12:01 p.m.

BY MR. SOMMER:

Q Sir, I'd like you to turn to page 177 of Exhibit 2036 and that's the Thackeray paper.

A Thackeray paper. What page again?

Q 177.

A 177. Okay.

Q Do you agree with me that the amount of lithium in the materials plotted on this page of the Thackeray paper influences the intensity of the peaks shown in the XRD data?

A Are you referring to the XRD data shown in Figure 2 on this page?

Q Yes, sir.

A It is not clear how the intensity of the peaks respond to the change of lithium because there's no Y-axis provided in these graphs.

Q And you can't tell anything about the intensity of the peaks of the -- the XRD data from the information provided in the Thackeray paper;

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is that correct?
A May I hear the question again?
Q Yeah. Let me rephrase it.
Can you tell anything about the intensity of the peaks from the XRD data presented in the Thackeray paper?
A In some cases, I think I can. For example, in Table 3b at page 179, they mention intensity for different peaks, but in some other cases such as Figure 2 at Number 177, we cannot tell the absolute intensity of these peaks in each of the spectra. What we can tell is the relative intensity of peaks in any given -- within any given spectra.
Q Would you agree with me that the relative intensity of the peaks in the XRD spectra change based on the amount of lithium in the composition?
A If their peak assignment those 400, 440 are correct, assuming those are, then the relative intensity of these peaks within each spectra appear to change with the number of lithium in the compound.

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Q Is that behavior something that you, based on your expertise and experience in the field, would have expected by changing the amount of lithium --
MR. ZHOU: Objection --
Q -- in the compositions?
MR. ZHOU: Objection, scope.
A Not necessarily.
Q What do you mean by not necessarily?
A Depending on the compound, the amount of lithium in the compound do not necessarily change the relative intensity within a compound -- I mean in -- in the context of XRD spectra.
Q Do you have any reason to doubt the data shown in the Thackeray paper for its accuracy?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that.
Q But you rely on it for comparative purposes in your declaration, correct?
A I refer to a data reproduced from Thackeray for analysis of my XRD results.
Q Do you believe that the data from the

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Thackeray paper is reliable?
MR. ZHOU: Objection, form.
A Again, I have not formed an opinion on that. But if you're asking me the general understanding of data coming from a database, then without reasonable -- reasonable doubt, we would just assume that the spectra presented in a database are true.
Q You wouldn't rely on data in your analysis that you believed to be unreliable, would you?
A I would not.
Q So you believe that the data that you're relying on from the Thackeray paper is, in fact, reliable, correct?
A I did not believe that the data presented in the Thackeray paper to be unreliable.
Q You had mentioned that your plots for the material you synthesized based on Kajiyama were confirmed against the XRD plot data provided in the paper itself; is that accurate?
A It's fair to say so.
Q Can you show me what XRD data in the

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Kajiyama paper you compared your plots to?
A Sure. The data I'm comparing to is figure -- I believe it's Figure 4, which is presented in my declaration at the top of page 20.
Q So Kajiyama mentions several different examples of layered lithium cobalt manganese oxide, correct?
A May I hear the question again?
Q Yeah. Kajiyama mentions several different compositions for layered lithium cobalt manganese oxide, correct?
A The Kajiyama paper in the discussion mention multiple lithium cobalt manganese oxide with various compositions.
Q The XRD pattern shown in Figure 4 is not for lithium 0.8 cobalt 0.5 manganese 0.502, is it?
MR. ZHOU: Objection, form.
A Figure 4 in Kajiyama is a characterization of a compound that has a -- maybe it's okay to call it molecular formula even though it's not a molecule. The formula is lithium .8 cobalt .5 manganese .5 oxygen 2.

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Q And -- and where do you see that in -- in Kajiyama?
A First, I believe the first mention of Figure 4 in Kajiyama is right below the Figure 4, 4 -- yeah, four lines under the graph it says Figure 4 shows an -- shows an XRD pattern of a lithium compound obtained by ion exchanging of sodium .7 cobalt, da da da. So this is a lithium exchange compound.
As for the exact composition of this compound, let me see where I can find it.
Okay. It appears that I have made a mistake. The XRD pattern shown in Figure 4, according to the -- my review at this very moment, it appears to me that the graph refers to a lithium exchanged compound of sodium .7 cobalt .5 manganese .5 O2, which I think correspond to a lithium .7 cobalt .5 manganese .5 O2 compound instead of lithium .8, as I said previously, even though when I prepared the declaration I was under the impression that this was lithium .8.
I do not recall the reason why I believe

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that was the case. But based on my review right now, it appears to me that this refers to lithium .7.
Q Okay. So are temperatures and times for heating active compounds important when preparing cathode materials for batteries?
A Not necessarily.
Q If you overheat active compounds for battery materials, can you negatively affect the quality of the material?
A Could you clarify the term overheat?
Q If you were to heat the cathode materials -- let me take a step back here.
You heated the cathode materials that you synthesized from Uemura, correct?
A I synthesized the samples according to Uemura by different forms of heating.
Q Okay. And one of the -- the steps of heating was heating it to 900 degrees centigrade, correct?
A That is correct.
Q If you were to heat it to, say,

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1200 degrees centigrade, would you expect that to have an effect on the compound that you produced?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that.
Q Based on your experience in the field, you don't have any understanding of whether heating it too much would affect the structure of the compound you created?
MR. ZHOU: Objection, scope.
A As I said earlier, not necessarily. Heating a compound to a specific temperature does not necessarily affect its structure.
Q Isn't it true that overheating the Uemura compounds would adversely affect their properties?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that. But then again as I said earlier, heating a compound to a specific temperature does not necessarily negatively affect its properties.
Q In the case of Uemura, doesn't he say in paragraph 61 that if you heat the product over 100 degrees centigrade it will decompose the

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product?
A Can you point me to passage?
Q Paragraph 61, sir.
A In Uemura?
Q Yes, sir.
A Uemura does mention that -- I would have to review the context of this passage.
So based on my very preliminary review of the context of line 61, Uemura is pointing that the product, it is not clear to me what product they're referring to, is decomposed if the temperature exceeds 1100 degree C.
Q Okay. Do you have any reason to doubt the accuracy of what he's saying there?
MR. ZHOU: Objection, scope.
A I have not formed an opinion on that.
Q Do you agree that if you heat active compounds for lithium-ion batteries for too long you can negatively affect the quality of the materials?
MR. ZHOU: Objection, scope.
A Not necessarily.

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Q At least in some circumstances is that true?
MR. ZHOU: Objection, scope.
A Would you ask the full question?
Q Under at least some circumstances, if you heat the active compounds for lithium-ion batteries for too long during the preparation of an electrode, can that negatively affect the quality of the materials?
MR. ZHOU: Objection, scope.
A Again, heating a particular battery electrode material under a certain temperature for a certain amount of time does not necessarily negatively affect the property of the material, but it -- what I say also means that it is possible in certain scenario where heating a temperature -- a material under a certain temperature for a certain amount of time could negatively affect its property.
Q You annealed the active cathode materials that you produced according to Uemura at 500 degrees for five hours; is that right?

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A Well, some examples, yes, I did heat the samples at 500 degrees C for a period of time.
Q What do you mean some examples?
MR. ZHOU: Objection, form.
A To the extent I recall, I did describe the synthesis of some samples at least at 500 degrees C. For example, paragraph 19 I heated these samples at 500 degrees C for five hours before further heating it at 900 degrees C for 24 hours.
Q Where does Uemura describe annealing in argon at 500 degrees for five hours before baking at 900 degrees for 24 hours?
MR. ZHOU: Objection, form.
A I do not recall Uemura heating their sample at 500 degrees C before heating at 900 degrees C. Heating at 500 degrees C is an extra, I would call it, a pre-annealing step that, to my knowledge, is common in the synthesis of lithium-containing compounds where high-temperature annealing is involved.
Q And where did you get that understanding, that this is a common process when

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high-temperature annealing is involved?
A Again, this is coming from my own experience.
Q Okay. Did Kajiyama employ this pre-annealing step to make the layered materials described in that reference?
A Kajiyama did not explore so-called pre-annealing in their synthesis of materials, at least to my understanding.
Q And Uemura doesn't mention this pre-annealing step either, correct?
A May I hear the question again?
Q Uemura doesn't describe the pre-annealing step either, does it?
A I do not recall them mentioning any pre-annealing step in their synthesis.
Q Okay. So that's something that you added based on your experience, not on any literature that you found about making layered lithium oxide materials; is that right?
MR. ZHOU: Objection, mischaracterize witness testimony.

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A This step is not related to the reference involved in reproducing Uemura's samples. I mean --
Q And --
A -- I didn't get this procedure from the exhibits, for example, cited in this declaration.
Q Where did you get the procedure from?
A It's from my own experience.
Q Okay. And as you sit here today, though, you're unaware of any literature or treatises or anything that describe that pre-annealing step to make layered materials; is that right?
A From my knowledge, this is a common practice as I mentioned when a high-temperature annealing is involved. The purpose of this pre-annealing is for the -- what is the better words to call it, for the lithium to kind of set in so that at a later stage, the lithium loss at higher temperature, I believe -- I'm not so sure actually, but there's a possibility that Uemura also mentioned the lithium loss.
It is a universal phenomenon in

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high-temperature synthesis of lithium compounds where lithium will evaporate, if that's a better word to call it. So people experience lithium loss at high temperatures. So to prevent this from happening, it is a common practice to first annealing -- anneal the compound at a much lower temperature for a short period of time to kind of set lithium in the structure to prevent a loss.

So it is not an attempt to alter the reaction path of synthesis but to prevent uncontrolled lithium loss.

Q And so it was your decision to add this additional step to the process described by Uemura; is that correct?

A It was my decision to add this pre-annealing step when I reproduce example 1 through 4 of Uemura.

Q How many attempts did you make at reproducing examples 1 through 4 of Uemura?

A How -- how do you define time?

Q I'm not asking about time. I'm asking about how many times did you try --

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A Yes. What -- how do you define the time in this sentence?

Q Okay. Let me go back to my other question because it didn't mention time.

How many attempts did you make at reproducing the examples 1 through 4 from Uemura?

A So how do you define the time -- the term attempt?

Q Okay. You recreated example 1 from Uemura, correct?

A I tried to reproduce the sample described in the example 1 in Uemura.

Q Okay. Did you synthesize the materials one time, two times, or more than that?

MR. ZHOU: Objection, form.

A I followed the method described in Uemura for the compound used in example 1 to synthesize the material, but I also make adjustments to the method in the hope of improving the material.

So if you count that as additional attempts then as, described in my declaration, I have attempted to synthesize the material for at least twice.

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Q Okay. So you tried to synthesize the material from Uemura example 1, two times; is that correct?

MR. ZHOU: Objection, mischaracterize witness testimony.

A I have tried at least twice using methods described in Uemura to synthesize the sample used in Uemura's example 1.

Q Okay. So the first time -- because I only see one attempt to make that material in your declaration. Is that -- is that accurate, you only reported on one of those attempts?

A In my declaration, I have reported a synthesis attempt based exactly -- based on exactly what Uemura described for the sample 1. And I have also described an improvement attempt which is shown in -- which is shown in section 6 starting from page 13 which is a slight modification to Uemura in the attempt to improve the material.

Q So you made --

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A The attempts were described in my declaration.

Q So let me make sure I understand.

So you did a first attempt to synthesize sample 1 from Uemura, and that's described at the beginning of your declaration, correct?

A That is correct.

Q And then you made improvements based on Kajiyama to Uemura's process; is that correct?

A That is not correct.

Q Okay. What exactly did you attempt to do to improve upon Uemura's process?

A As described in section 6 in my declaration starting from page 13, I switched annealing atmosphere from argon to air which I found to be the much more commonly used condition with synthesis of layered compounds involving lithium and transition metal and oxygen. So this is the improvement I tried to make.

Q Okay. So you did one method, and I think you said you tried to do it exactly based on what Uemura describes; is that right?

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MR. ZHOU: Objection, mischaracterize witness testimony.

A I try to use the condition described in Uemura for sample 1. And because they use -- they describe they use argon as the annealing atmosphere, I follow exactly this description as using argon for my annealing atmosphere as well.

Q But you also made some changes to the Uemura process including this pre-annealing step, correct?

A That is correct.

Q Other than this pre-annealing step, what other changes did you make to the Uemura process in your attempt to change it?

MR. ZHOU: Objection, mischaracterize witness testimony; form.

A Depending on what you define as adjustments, the list could go on for days because Uemura doesn't really describe many of their steps in great detail. For example, they didn't mention what apparatus to use to do the mixing of the different chemicals. They didn't mention the --

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the apparatus to use to do the annealing. If you also consider these as modifications, then it would be very hard to comment.

Q Okay. What other process steps did you employ beyond those that are mentioned in Uemura?

MR. ZHOU: Objection, form.

A Again, because many details in Uemura is left out, depending on how you define it, you may consider everything I did as a modification. But I believe a person of ordinary skill would not consider those as modifications. So if you consider that, then I would not even consider the additional pre-annealing as a modification because, as I said, I do not expect this additional step to even change the reaction path of the synthesis.

So based on this understanding, I would say that I did not make material adjustment to the method described in Uemura for the synthesis of materials described in example 1 through 4.

Q So there are many modifications then that you would -- you -- you did, in fact, make but you

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just don't consider them important modifications because you don't believe they impact the synthesis path; is that correct?

MR. ZHOU: Objection, mischaracterize witness testimony; and form.

MR. SOMMER: Okay. Robert, I'm going to tell you that that's an inappropriate objection. I've been letting this go on for quite some time. Your objection should be limited to form or privilege in the context of IPR.

MR. ZHOU: I disagree with that. We can leave it here.

A Again, because the description of Uemura is not particularly detailed as for what they use and how they do many steps, it is totally up to the person trying to replicate to decide what -- how these steps are performed. It is almost -- for the information provided by Uemura, it is impossible for anyone in the world, I would say, to do exactly the same as they did unless you are in the same lab using their equipment at the same time.

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But I would say that I have followed the procedure described in Uemura to the extent that I do not make modification that would alter the outcome of the experiment.

Q Okay. So example 1, you did one attempt using argon as described in Uemura. And you did one attempt in an air atmosphere based on your research and experience; is that fair?

A It's fair to say.

Q Okay. Did you also do one experiment using the argon atmosphere for example 2 and one experiment for an air environment on example 2 as well?

MR. ZHOU: Objection, form.

A I have used argon as the annealing atmosphere for compounds described in Uemura's example 1 through 3 in the attempt to reproduce what Uemura described but seems none of the compounds appear to show a layered structure as claimed in Uemura.

I modified the synthesis procedure of the -- of all the samples described in Uemura

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example 1 through 3 in air instead to try to obtain the layered structured claimed in Uemura.

Q Would it be fair to say you synthesized six total samples, three made in an argon atmosphere and three made in an air atmosphere based on Uemura?

A Because there are three samples synthesized according to example 1 through 4 in argon and another three in -- in air also for example 1 through 4, so in total there are six compounds synthesized from these two groups of attempts.

Q Are you familiar with the term ramp rate?

MR. ZHOU: Objection, scope.

A I'm not familiar with the term.

Q Okay. How quickly did you heat the samples between room temperature and 500 degrees centigrade when you did your pre-annealing step?

MR. ZHOU: Objection, form.

A I don't believe I have described this parameter in my declaration so I can only speak from my memory. If I remember it correctly, I may

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have used 5 degree per minutes for heating.

Q And did you use that same 5 degrees per minute heating when you changed the temperature from 500 degrees Celsius to 900 degrees Celsius?

A I do not recall the specifics.

Q Okay. Other than heating at 500 degrees for five hours and then heating at 900 degrees for 24 hours, did you perform any other heating processes on the electrode materials or the electrode itself?

MR. ZHOU: Objection, form.

A After the synthesis of these materials and before the assembly of cells based on these materials, these materials were subjected to electrode preparation where solvents are used. And also before transferring the electrode prepared into the glove box where we performed the cell assembly, we do need to heat up the electrode to remove any remaining solvent and moisture in the electrode, which is a common practice in battery research.

But that heating temperature is generally

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under 100 degrees C which is, by far, lower than synthesis temperature of 900 degrees C used in the synthesis. So if you do not count that heating, the level of heating as additional heating, then the answer would be no, we did not perform additional heating of these materials.

Q Okay. The drying or the removal of these solvents, you said you heated -- you warmed the material at under 100 degrees Celsius for some period of time; is that right?

A That is correct.

Q How long did you apply that warming, let's call it? Just because I -- I know you're distinguishing between high heat and this lower temperature.

A How long for this low-temperature heating?

Q Yeah.

A It is typically a few hours.

Q Do you recall how many hours you used to -- for these particular experiments?

A I do not recall.

Q Okay.

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A This is also a process where the time is usually not mentioned in general battery research. I do not believe Uemura also described their time of heating their electrode.

Q Okay. In paragraph 25 of your declaration, you mention using a molybdenum electrode or current collector; is that right?

A That is correct.

Q Why did you select that material?

A The general choice of material for electrode current collector for an electrode is to make sure that this material is inert to the material we used in a battery and it can withstand the potential we apply to the electrodes.

In this regard, molybdenum is usually a pretty stable material to use in batteries and that is why we chose molybdenum in our case.

Q What else did you consider for the electrode material instead of molybdenum?

MR. ZHOU: Objection, scope.

A As I said, there are several considerations. We need to consider chemical

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compatibility, that it doesn't react with the materials we use, and also the potential we apply. Based on these considerations, different materials may be used in different batteries. I'm not sure if that answer your question.

Q I don't think it did. Did you consider using anything other than a molybdenum electrode for the experiments discussed in your declaration?

MR. ZHOU: Objection, scope.

A There are different possible materials to use, but we -- I consider molybdenum as a suitable material to use in this case.

Q Now, you mixed each of the Uemura active materials that you prepared with acetylene black and PTFB; is that right?

A That is correct. For a simple -- for electrode preparation.

Q After you mixed those things together, what else did you do to prepare the electrode?

A After mixing, I process them into a layer that has the desirable areal loading and kept these areal layers into the desirable sizes, such

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as those described in my cell assembly procedure where we have used 7-something millimeter in diameter. And then dry these electrodes before transferring them into the glove box for cell assembly. That is pretty much what I did for the electrodes.

Q How did you process them into a layer?

A Mainly through -- I don't know what is the best word to describe it, but the mixture of the active material, acetylene black, and the binder are -- may I use the word impacted or -- they are mechanically -- what is the word he used?

So it's like applying a force on the -- on the mixture repeatedly until it forms a self-standing layer, sort of form.

Q And what pressure did you apply to impact the mixture?

A Because this process is performed in a pestle and mortar that I had mentioned this in my description, I do not recall if I mentioned this particular process, but this is done by pestle and mortar. And because it's done by hand, I didn't

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measure the pressure I apply in the mixing.

Q I see. So you applied this pressure by hand; is that right?

A That is correct.

Q Okay. But Uemura describes applying two tons per centimeter squared of pressure in forming the electrodes, right?

MR. ZHOU: Objection, form.

A Let me pull up the procedure Uemura describes.

So Uemura may have described different methods of make their electrodes, but I'm only picking this example where it does say two-ton per centimeter square as an example.

So in line 75, Uemura appeared to describe a process of mixing acetylene black, PTFB and their active material in a certain mass ratio. What they didn't mention is what the pressure they -- what the pressure they apply was in this mixing. They did mention a pressurizing step where they formed this mixture into a disc.

So it appears to be at least a two-step

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formation to get a disc-formed electrode.

Q Now, you applied basically a one-step process to make your disc electrode, correct?

MR. ZHOU: Objection, form.

A I mixed the electrode I used with a hand-operated pestle-and-mortar method without going through a high-pressure pelleting step.

Q You don't believe you applied anywhere near two tons per centimeter pressure to your electrode; is that right?

MR. ZHOU: Objection, form.

A I have not formed an opinion on that.

Q Are you capable of applying two tons per centimeter squared of pressure on anything?

MR. ZHOU: Objection, form.

Q Physically?

A I do not know, sir.

Q Okay. You mentioned a glove box. When you assembled your cells, did you use an argon glove box to prepare your cells?

A The glove box I used for cell assembly is filled with argon gas.

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Q Okay. And are you familiar with the concept of an experimental control?
MR. ZHOU: Objection, scope.
A I would like you to define the term you just used in your question.
Q The control aspect?
A I believe you mentioned a concept that consisted of three words.
Q Okay. I asked you are you familiar with the concept of an experimental control.
A Depending on the context, experimental control could mean different things. So would you like to clarify the definition --
Q Sure.
A -- the definition of this?
Q So in science experiments, are you aware that it is common to use controls, meaning other samples having known properties, to minimize the affect of variabilities or variables on the results --
MR. ZHOU: Objection, scope.
Q -- of the experiment?

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MR. ZHOU: Objection, scope; form.
A I suspect what you are trying to say is to use something that is the -- my understanding is that you are saying that the property of Uemura may -- may be considered as an unknown and we should use something that is better known to compare with the result I obtained when reproducing Uemura's results; is that correct?
Q I don't think my question was -- was that specific, but that is an example that I think helps define the concept of an experimental control: Taking a known characteristic or property and comparing it under the same circumstances to something else that's unknown.
MR. ZHOU: Objection, form.
Q Have you ever done that in experimental testing before?
MR. ZHOU: Objection, scope; objection, form.
A In my set of experiments, I tried to validate the observation we have made with the -- the compounds we synthesized to reproduce Uemura's result by also performing an experiment including the synthesis and cell characterization of a layered compound according to Kajiyama.
We have synthesized a layered compound and we have obtained results that resemble those described in Kajiyama which should validate the electrode making, both the annealing, electrode making, and cell-testing procedure.
So if this is the -- perform as a control you mention, then we probably have done control. And if this understanding is correct, then yes, I'm aware of the term control if the context is similar to what you are describing.
Q When you tested the samples you made from Uemura, what charging rates did you apply to them?
A I have described the charging rate in my description. So in my declaration, I have provided certain milliamp per centimeter square as the charging rate, but these rates usually come down to the current relative to the active material we use. And these are usually considered as C over 5, which is -- well, this is difficult

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to describe, but it is the current used relative to the active material used in an electrode.
And during the performance of these experiments, I tried to keep the charging rate the current for mass of active material similar to those described in Uemura.
Q Okay. So that was what you were trying to do, was obtain the same or very similar charging rates to those used by Uemura, correct?
A That is correct.
Q And how close do you think you came to that? You said -- actually, I'll withdraw the question. I'll try to ask this again.
You said you think you applied a C over 5 charging rate?
A Yes.
Q Okay. Let's talk about paragraph 43 of your declaration briefly.
A Number 43?
Q 43.
A 40 --
Q It's on page 21.

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A Yes. I -- it's a two-line paragraph, correct?
Q Yes. It's brief. You mention a hard carbon, correct?
A Correct.
Q And that you used as an anode material, correct?
A Correct.
Q Where did you get the hard carbon material?
A The hard carbon material is a commercial compound. It's commercial.
Q So it's something that you purchased from a supplier; is that correct?
A That is correct.
Q How do you know that it had a capacity of 390 milliamp hours per gram?
A This is the advertised value.
Q Do you know where you purchased this hard carbon?
A I do.
Q And where was that?

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A The brand name of hard carbon, I'm not sure how to pronounce it. It spells K-U-R-A-R something. If you want a particular name, I can pull up it now for you, if that's something you want to do.
Q I mean, if you remember it, that -- that's fine. A-U-R-A is what you said?
A That is not correct. It spells K, as in Karen, U as --
Q Oh, K.
A -- universe. I believe again K, as in Karen. Probably A, as in apple.
Q Okay.
A I don't recall the rest of it.
Q Okay.
A It's something similar to that.
Q Okay. Now, you tested three cells that you made according to layers in Kajiyama, correct?
A I described testing of three cells with the compound synthesized according to Kajiyama.
Q Okay. And two were made into cells using lithium metal as the negative electrode, correct?

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A That is correct.
Q Did those two cells made with the lithium metal negative electrode perform consistently with the data reported in Kajiyama?
A The results I obtained with the material synthesized according to Kajiyama did show consistent performance as reported in Kajiyama.
Q So they were consistent with Kajiyama, correct?
A Correct.
Q Would you say that the two cells you made with lithium metal as the anode material perform -- performed better than the cell that you made using the hard carbon material?
MR. ZHOU: Objection, form.
A The cell I assembled using lithium as the anode show performance consistent with what was reported in Kajiyama. As for the cell assembled with hard carbon, that cell is not reported in Kajiyama so it would be difficult to evaluate which one is good or not. But because they -- these cells use the same cathode material, I can

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only assume that they performed similarly.
Q Well, you made these cells and tested them. Did you do anything to compare the performance of the cells that you made with the negative -- I'm sorry, the lithium metal negative electrode with the cell that you made using the hard carbon negative electrode?
MR. ZHOU: Objection, scope; form.
A I did not put profile of cells with lithium as anode and hard carbon as anode in the same figure. If you -- if you define that as a comparison, then that was not performed.
Q In connection with the testing that you described in your declaration, did you have to rent any equipment?
A I do not recall renting any equipment.
Q Okay. Paragraph 19 of your declaration, you mention grinding 1.5 grams of an intermediary so that it was finely ground.
Did you do anything to measure the particle size?
A No. I did not.

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Q Once you synthesized the materials from examples 1 through 3 from Uemura, did you do anything to experimentally check how much lithium was actually in the materials that you made?
MR. ZHOU: Objection, scope.
A I assume you are talking about the lithium amount relative to the combined amount of manganese and cobalt, a concept that was brought up earlier in this deposition. In that case, yes, I have characterized the lithium concentration in some examples.
Q And where did you report that in your declaration?
A That experiment was performed during the -- okay. So this is the -- the -- so we have a limited time frame of performing these set of experiment. And by the time I prepared this declaration, that result was not available to me yet. And I received the result of those characterizations after the filing of this declaration, which is why those numbers are not included in this declaration but we do have those

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data.
Q Okay. But you're not relying on that data in connection with your declaration, correct?
A I did not consider the lithium concentration in these materials. Instead, I presumed that the lithium concentration in these compounds are consistent with the -- roughly consistent with the amount of lithium compound I put in the synthesis.
Q Okay.
A But as the characterization turned out, the lithium concentration in these compounds are consistent with the design concentration of lithium. And the same can be said for the concentration of manganese and cobalt as well.
MR. SOMMER: Move to strike as nonresponsive, at least as to the testimony about the results that were not included in the declaration.
Q Now, you said that the materials that you fabricated or synthesized were gray but Uemura's were brown; is that right?

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A Are you referring to the wording I use in paragraph 18?
Q Let me check if that's one of the paragraphs in which -- yeah. You refer to deep gray powders in paragraph 18, right?
A I describe the color of the intermediate powder in paragraph 18 as deep gray instead of -- I believe Uemura used brown in their description.
Q And so you did not produce brown powders like described in Uemura, correct?
A It is my understanding that deep gray is a very deep color and brown is also a deep color. I believe the perception of color varies from person to person. I have personally observed people call very deep color samples as different colors. So I would not be surprised if the brown color described in Uemura would be actually a deep gray in my sample. I'm using a wording that may be slightly different than Uemura's to truthfully reflect my own observation.
But since these colors are all deep, it may be dependent on the -- the person to describe

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the exact color of these -- the exact term for these colors.
Q Did you take any photographs of the materials?
A I do take photograph for select compounds I synthesize, but -- yes.
Q So do you have photographs of the materials that you synthesized based on Uemura?
A For select samples, yes.
Q Which samples?
A I do not recall.
Q And do you still have those photographs?
A It is possible.
Q But you're not sure one way or the other?
A I cannot guarantee.
Q Did you take them with your phone?
A Yes, I did.
Q Okay.
MR. SOMMER: Counsel, we're going to request those photographs. We can take this up after the deposition if you want because I'm really close to wrapping up here.

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MR. ZHOU: We can take it under advisement.
MR. SOMMER: Okay.
Q Sir, do you believe that Uemura falsified the data that is reported in the patent?
A I have not formed an opinion on that.
Q Okay. So that's not what you're saying in your declaration, that -- that Uemura was unable to fabricate the -- the compositions described in the reference; is that fair?
Let me strike the question. That's a confusing question. Let me try to re-ask it.
You are not saying that you believe Uemura fabricated the results in the patent application publication that you reviewed, correct?
MR. ZHOU: Objection, form.
A Fabrication is a serious accusation. All I can say is that from my best attempt to reproduce the examples described in Uemura plus more, I was not able to reproduce these compounds. And also based on my understanding of the synthesis of layered compounds involving a large

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concentration of manganese inside, it is -- it should be well known, even in the year of 2001 I believe, 2002, that direct synthesis of layered compounds of lithium manganese oxide where the -- no, I mean lithium transition metal oxide where manganese has a high concentration would be difficult. That would be my understanding.
Q Fair enough.
MR. SOMMER: I have no further questions.
MR. ZHOU: So let's take a break for 20 minutes and then come back. We may have some questions for redirect.
THE VIDEOGRAPHER: We're going off the record. The time is 1:19 p.m.
(Whereupon a break was had.)
THE VIDEOGRAPHER: We are back on the record. The time is 1:50 p.m.
MR. ZHOU: I just have a few redirect questions.
EXAMINATION
BY MR. ZHOU:
Q Dr. Liang, do you recall being asked about

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Figure 4 of Kajiyama?
A Today, yes.
Q Do you recall you testified that you may have made a mistake in your testimony about which particular compound Figure 4 of Kajiyama is about?
A I do.
Q Does that mistake change your conclusion one way or the other whether you have successfully synthesized a layered compound that is suitable for replicating example 2 of Uemura?
A No. I don't think so.
Q Why is that?
A As I said, when I answer one of Andrew's questions today, lithium content in a material may or may not change the XRD pattern of a specific compound. And in this specific case, lithium X cobalt .5 manganese .5 O2 sample I synthesized which has the composition of .8 supposedly, and the XRD pattern that is assigned to supposedly lithium .7 cobalt .5 manganese .5 O2 have almost exactly the same pattern which means that, first, the lithium content in this particular compound

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group does not change the XRD pattern of -- in an obvious way; and second, the fact that the XRD pattern of the compound I synthesized according to Kajiyama and the XRD pattern Kajiyama presented for their compound as a representative of the group of their compounds mesh, I would say, perfectly indicate that these compounds, the compounds they presented and the compound I synthesized, share very similar crystal structure which is why I believe the compound I synthesized shared the layered structure as claimed in Kajiyama.
Q Does that mistake change your opinion described in your declaration in any way?
A I don't think so.
Q Dr. Liang, do you recall that you were asked about paragraph 75 of Uemura today which states that the mixtures as obtained were pressurized with two-ton centimeter square to form a disc with a diameter of 12-millimeter?
Do you recall that?
A I do recall that.

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Q Do you recall testifying today that you applied the pressure by hand?
A Yes, I do.
Q Does the fact that you did not apply the two-ton centimeter square pressure to the cathode material change your view one way or another whether you have successfully reproduced the experiments as described in Uemura?
A No. I don't think so.
Q Why is that?
A First, the method I used the prepare the electrode I made for the cells I tested is a common practice in the battery community and it is fully -- fully rational to use such a method to fabricate electrode for characterization of the electrochemical property of active materials.
And second, according to my understanding, the use of pressure in the fabrication of electrodes in the battery community is usually employed to increase the structural stability of the electrodes. And if such improvement is achieved by applying a high pressure on the

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electrode, the usually expected outcome could be an increase of cycle life. If the structural stability can be improved at all, then the cycle life of the electrode may also be improved. That is a possible outcome.
Another possible outcome is that the structure of the electrode by itself is already good enough and no pressure is needed. In that case, the cycle life will be minimally affected by the use of pressure.
I am concerned, though, that the use of pressure might decrease the porosity of the electrode. And in that case, the mass transport in the electrode could be negatively impacted by the use of high pressure, especially two-ton, which it feels like a lot. So if that is the case, then the -- the electrode profile will be negatively impacted in terms of specific capacity, for example, and may be increasing polarization during charge and discharge.
But then again, that is only a possible outcome. It is not necessary. It is also

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possible that upon applying such a pressure, the porosity of the electrode is decreased but not to the extent that it would affect the performance of the electrode.
In that case, the specific capacity and polarization may be only minimally impacted by the use of pressure. So in -- in the experiments I carried out, I only -- I'm only interested in the -- or for at least the results we obtained, we are only focusing on the material utilization or more specifically the specific capacity. And in that case, I do not think the use of pressure or high pressure or not would impact the result I observed; and thus, I do not expect a change of my view of the success of this material as active materials for electrodes.
Q You just mentioned that it's possible that there may be some cycle life improvement.
In your view based on your experimental results, would any potential cycle life improvement be significant in your view or would that affect any of your conclusions in your

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declaration?
MR. SOMMER: Objection to form.
A May I hear the question again?
Q You just mentioned that, in your view, the pressuring step may have affect on the cycle life performance of the battery.
Would any potential cycle life improvement be significant in your view or will it affect any of your conclusions in your declaration?
A As I mention, the impact of pressure on electrode is -- is very context-dependent. It is not a necessary outcome if the cycle life improve or not by using the additional high-pressure formation step for the electrode.
And also, because we didn't even discuss the cycle life of the materials in this -- in this replication or reproducing of Uemura, we didn't -- the capacity is typically so low that cycle life is not even a factor for consideration. So any effect that may or may not appear after application of this pressure is not a factor for consideration during my preparation of the

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declaration.
MR. ZHOU: I have no further questions.
MR. SOMMER: I have a couple of follow-up questions.
FURTHER EXAMINATION
BY MR. SOMMER:
Q Dr. Liang, after I asked my last question, we took a half-an-hour break. This is a yes-or-no question.
Did you spend that half an hour speaking with counsel for RJ Tech?
MR. ZHOU: Yeah. I caution the witness not to reveal any privileged communications.
A During the half-hour break, I did speak with my attorneys from -- wait, what is your question again?
Q I'm asking if you spent the entire half an hour speaking with counsel for RJ Tech. It's a yes-or-no question.
A When you said counsel for RJ Tech, you mean persons like Robert; is that correct?
Q Yes.

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A I did speak to Robert during the break.
Q And for the entirety of the half an hour; yes or no?
A That is a no.
Q No. Okay. How long did you spend speaking with Mr. Zhou?
A I do not recall.
Q Okay. Twenty minutes?
A I would have to guess because I didn't time our conversation, but I would say it would be approximately half of the break.
Q Okay.
A I would say about 15 minutes.
Q Okay. That's fair. You mention that it's common practice in the battery industry to apply pressure by hand when forming an electrode, correct?
A It is one common practice to fabricate electrodes.
Q One -- one common practice, correct?
A That is correct.
Q What do you base that conclusion on?

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A That is not a conclusion, but -- well, I will only say that is an observation based on all the years I have worked in the battery field. I saw repeatedly people use the same procedure to evaluate their electrode materials.
Q Okay. So this comes from your observations of your work in the field, correct?
A That is correct.
Q You don't base it on any literature that you've read, correct?
MR. ZHOU: Objection, form.
A The decision to use this method is based on my understanding of the method described in Uemura. Uemura described using a PTFB powder as the binder for the electrodes they characterized. So I used the same binder for our system.
And for the use of PTFB as a binder for electrodes one of the typical method is to use mortar and pestle and use hand to apply pressure to form an electrode. And that is what I used.
Q Okay. But that's not based on any research in the literature you did, correct?

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MR. ZHOU: Objection, form.
A I did not refer to any specific paper in the preparation of my experimental procedure for the reproduction of the experiment described in Uemura.
Q And you chose to ignore Uemura's application of two tons per square centimeter in preparing your electrode, correct?
MR. ZHOU: Objection, form.
A Based on the purpose of the evaluation of our replication of what is described in Uemura, I decided that the -- I decided that not using an additional high-pressure step is not a material modification of Uemura and it should not impact the outcome I observed. And that is why I did not adapt that particular procedure in my replication effort.
Q So you made that choice intentionally when you were creating the experimental electrodes that you tested in your declaration, correct?
MR. ZHOU: Objection, form.
A Can I hear the question again?

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Q Yeah. That was a decision that you voluntarily made when you were creating the experiments that you're describing in your declaration? You chose not to do that at the time because you didn't think it would matter, correct?

MR. ZHOU: Objection, form.

A I have taken the necessary steps I think would be necessary to replicate what is described in Uemura. And in this case, I chose to use a pestle and mortar operated by hand to reach the goal to replicate Uemura's results.

MR. SOMMER: All right. I have no further questions.

THE VIDEOGRAPHER: All right. Is that everyone?

MR. SOMMER: Yeah. Robert, we'll follow up in writing following the deposition on the photographs from Mr. Liang's cell phone.

MR. ZHOU: Okay.

THE VIDEOGRAPHER: We're going off -- sorry.

This marks the end of the deposition of

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Yanliang Leonard Liang. We are going off the record at 2:07 p.m.

THE REPORTER: And I have --

MR. SOMMER: Thank you very much, everybody, for your time. Sorry.

THE REPORTER: That's okay. Sorry, I standing orders, Mr. Sommers -- Sommer, for rough draft and an expedited for Monday.

MR. SOMMER: That's fine. We can take it Tuesday or Wednesday, I mean, if that's easier for your schedule given the holiday. You know, I'm in not -- I'm certainly not going to be reading it Monday.

THE REPORTER: It's all the same for me.

MR. SOMMER: Okay. All right.

THE REPORTER: Mr. Zhou, do you want the same order?

MR. ZHOU: No. Regular is fine.

THE REPORTER: Do you want the rough draft?

MR. ZHOU: Yeah, rough draft, yes.

THE REPORTER: But regular delivery for

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the final?

MR. ZHOU: Correct.

(Whereupon the proceedings were concluded at 2:08 p.m. CT)

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CERTIFICATE OF SHORTHAND REPORTER

I, Karisa Ekenseair, Certified Reporter and Notary Public within and for the State of Arkansas do hereby certify: That YANLIANG "LEONARD" LIANG, PHD, 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.

I further certify that the adverse party, RJ Technology LLC was represented by counsel at the deposition.

I further certify that the deposition of YANLIANG "LEONARD" LIANG, PHD, occurred virtually on July 2, 2024, commencing at 9:02 A.M. CT to 2:08 P.M. CT.

I further certify that I am not related to any of the parties to this action by blood or marriage, I am not employed by or an attorney to any of the parties to this action, and that I

am in no way interested, financially or otherwise, in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 5th day of July, 2024.

My commission expires: 6-18-2028

Karisa Ekenseair, CCR, RPR RMR LS #802
Notary Public in and for
Pulaski County, Arkansas
Commission No. 12704567

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