

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
3

4 LG ENERGY SOLUTION, LTD.,

5 Petitioner,

6 v.

7
8 MOLECULAR REBAR DESIGN, LLC,

9 Patent Owner.

10 Case IPR2024-01013, (U.S. Patent Number 10,153,483)
11 Ref. 18768-0210IP6
12

13 VIDEOCONFERENCE DEPOSITION OF

14 DEBORAH D.L. CHUNG, Ph.D.

15 INDIVIDUALLY AND ON BEHALF OF

16 PATENT OWNER

17 JULY 2, 2025

18 Page 1 - 34

10:06 a.m. to 10:58 a.m. EST

19
20 REPORTED BY:

Tamara L. Houston

21 CA CSR No. 7244, RPR, CCRR No. 140

22 Job Number J12853868
23
24
25

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

REMOTE VIDEOCONFERENCE DEPOSITION OF DEBORAH D.L.
CHUNG, Ph.D., taken on behalf of the Petitioner,
commencing from 10:06 a.m. to 10:58 a.m., Wednesday,
July 2, 2025, before Tamara L. Houston, CSR No. 7244,
CCRR, RPR.

THE SULLIVAN GROUP OF COURT REPORTERS

APPEARANCE OF COUNSEL:

On behalf of the Petitioner:

**FISH & RICHARDSON P.C.
BY: HYUN JIN IN, ESQ.
1000 Maine Avenue SW
Suite 1000
Washington, DC 20024
(202) 783-5070
in@fr.com**

On behalf of the Patent Owner and Witness:

**CABELLO HALL ZINDA, PLLC
BY: STEPHEN ZINDA, ESQ.
801 Travis Street
Suite 1610
Houston, Texas 77030
(832) 631-9994**

THE SULLIVAN GROUP OF COURT REPORTERS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

INDEX TO EXAMINATION

WITNESS: DEBORAH D.L. CHUNG, Ph.D.

EXAMINATIONS	PAGE
Mr. In.....	6

QUESTIONS INSTRUCTED NOT TO ANSWER

Page	Line
NONE	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

INDEX TO EXHIBITS

DEBORAH D.L. CHUNG, Ph.D.

LG ENERGY SOLUTION, LTD. vs. MOLECULAR REBAR DESIGN, LLC

JULY 2, 2025

Tamara L. Houston, CSR No. 7244, CRR No. 140, RPR

EXHIBIT	DESCRIPTION	PAGE
----------------	--------------------	-------------

NONE MARKED.

--000--

1 WEDNESDAY, JULY 2, 2025, 10:06 A.M.

2 --o0o-

3 COURT REPORTER: My name is Tamara Houston,
4 California Certified Shorthand Reporter Number 7244.

5 --o0o--

6 DEBORAH CHUNG, Ph.D.,

7 called as a witness

8 was sworn and testified as follows:

9 --o0o--

10 EXAMINATION BY MR. IN:

11 Q. Good morning, Dr. Chung. My name is Hyun Jin
12 In. I represent Petitioner LG Energy Solutions in this
13 case.

14 How are you this morning?

15 A. Good. Thank you.

16 Q. Could you just please state your full name for
17 the record.

18 A. Deborah D.L. Chung.

19 Q. Great. Thank you. I realize this is now the
20 fifth deposition that we're having with you just in this
21 past week. So, first, thank you for bearing through all
22 of that.

23 And, second, I'm going to skip past all of the
24 background materials and discussions we've gone through
25 before.

1 Is that okay with you?

2 A. Yes.

3 Q. Is there any reason why you can't give
4 truthful testimony today -- this morning?

5 A. No.

6 Q. Okay. So today, as you know, I will be asking
7 you some questions related to the '483 patent, and that
8 is Exhibit 1001.

9 Do you understand that?

10 A. Yes.

11 Q. And since our deposition concluded yesterday,
12 what did you do to prepare for today's deposition?

13 A. I reviewed, you know, the main documents,
14 which is my dec -- I mean, my declaration and also
15 this -- this patent, '483. I believe that's the number,
16 and I reviewed some of the information -- kind of
17 summarizing information provided to me by the counsel.
18 I also had a short Zoom session with the counsel this
19 morning.

20 Q. And when you say "Counsel," is that Mr. Zinda?

21 A. Yes.

22 Q. Did you meet or discuss with anyone else?

23 A. No.

24 Q. So if I could direct your attention to the
25 '483 patent, Dr. Chung. Let me know when you have it up

1 on your computer.

2 A. Yes, I have it.

3 Q. Okay. You've reviewed this patent, correct?

4 A. Review what?

5 Q. You have reviewed this patent?

6 A. I'm not getting the words.

7 Q. Sorry.

8 MR. IN: Are others having trouble hearing me
9 as well?

10 MR. ZINDA: It was just a little bit choppy.
11 I think if you just ask again, she probably can hear it.

12 BY MR. IN:

13 Q. Okay. Have you reviewed this patent,
14 Dr. Chung?

15 A. You mean the specs? Is that --

16 Q. This document, Exhibit 1001.

17 A. Yes. I have.

18 Q. So it's fair to say that you understand this
19 '483 patent; is that right?

20 A. Yeah. Basically, yes.

21 Q. If you could go with me to the last page of
22 the patent document where we have the claims.

23 Do you see that?

24 A. Yes.

25 Q. Did you review these claims?

1 A. Yes.

2 Q. Did you review all of the claims?

3 A. Pretty much. The last -- I didn't dwell on
4 the last few as much as the beginning few.

5 Q. Okay. But fair to say you understand each
6 claim?

7 MR. ZINDA: Objection. Form.

8 THE WITNESS: Well, I understand what it's
9 saying, yes.

10 BY MR. IN:

11 Q. Okay. And that means you understand all of
12 the terms in the claim; is that fair?

13 A. Yeah. All of the important terms, I would
14 say. I know what they are, yes.

15 Q. What do you mean by "important terms"?

16 A. I -- you know, I suppose I understand all of
17 those. There are so many words here. Yeah. I would
18 say I -- I understand meaning of all these terms as far
19 as what they mean, you know, just the -- the face of the
20 meaning.

21 Q. What do you mean by "the face of the meaning,"
22 Dr. Chung?

23 A. Oh, that is what the -- the -- the accepted
24 scientific meaning of the term.

25 Q. Okay. And you applied those accepted

1 scientific meanings of the terms in your review of these
2 claims and as part of your declaration; is that fair?

3 A. Yes.

4 MR. ZINDA: Object to form.

5 THE WITNESS: Yeah. I reviewed these and --
6 and what I wrote in the declaration reflects the
7 understanding of the accepted scientific meaning of
8 those terms.

9 BY MR. IN:

10 Q. If you could also pull up for me, Dr. Chung,
11 Exhibit -- MRD Exhibit 2006, which is your declaration.

12 A. Yes.

13 Q. You are looking at a clean, unmarked copy of
14 that; is that right?

15 A. Yes.

16 Q. Did you review this document in preparing for
17 today's deposition?

18 A. Yes.

19 Q. Do you recall if there were other materials
20 that you relied on in putting together this declaration?

21 A. Yes.

22 Q. And what were those documents?

23 A. Those are listed as exhibits in my
24 declaration.

25 Q. Could you point me to -- to where you're

1 referring to, Dr. Chung?

2 A. Well, okay. The list of exhibits is on page
3 426.

4 Q. Are you aware of any other documents or papers
5 or materials that you reviewed but did not include as
6 part of this exhibit list?

7 A. Yeah. I've considered other documents, but
8 these are the ones that I really relied on.

9 Q. Do you recall any of these other documents?

10 A. Well, there are the documents such as this
11 patent itself. This patent itself is not listed.

12 Q. And that's because that would be an LGES
13 exhibit, so that would have been listed in the LG's
14 filing.

15 So I guess you relied on exhibits submitted by
16 MRD and also exhibits submitted by LGES, right?

17 MR. ZINDA: Objection. Form.

18 THE WITNESS: Yeah. I relied on the exhibits
19 that are listed in my declaration, but I consider the
20 other documents such as those exhibits provided by LG.

21 BY MR. IN:

22 Q. Okay. Do you recall considering any other
23 documents that are not listed in either LG or MRD's
24 filings?

25 A. I considered other -- let me see... yeah, I

1 did literature search to look for articles such as
2 journal papers that are relevant. So in the process of
3 that literature search, I came across various papers.

4 Q. So are some of the papers that are listed on
5 pages 4 through 6 of your declaration the results of
6 that literature search that you performed?

7 A. Yeah. For instance, Figure 13 on page 72 of
8 my declaration is an SEM micrograph, and this micrograph
9 comes from a paper that I found through my literature
10 search.

11 Q. Were there any papers that you found through
12 your literature search that you did not mention in your
13 declaration?

14 A. I don't think so. Oh, let me see. I was
15 looking at the photos, but I should not be just looking
16 at photos.

17 I don't have all of the exhibits there.

18 Q. And just to be clear, Dr. Chung, I wasn't
19 asking about the exhibits that are part of this
20 proceedings record. But I was more asking about the
21 literature search that you say that you performed and
22 whether you have the listing of references that you
23 found that you reviewed but ultimately did not include
24 as part of your declaration.

25 A. Oh, I see your question now.

1 I did not even keep a record of those papers
2 or publications that came up during the search. I just
3 looked through a lot of them, mainly the title and the
4 abstract, and did not even keep track of them.

5 Q. Okay. If I could go with you in your
6 declaration to paragraph 67, which is on page 36.

7 A. Page, 67. Yes, I have it.

8 Q. No. Paragraph 67, page 36.

9 A. Okay. Got it.

10 Q. And I just wanted to ask you just briefly
11 about the first sentence in that paragraph.

12 Could you, to refresh your memory, read that
13 first sentence of paragraph 67.

14 A. Yes.

15 Q. And you could read it out loud, Dr. Chung.

16 A. Okay. "While the conventional wisdom at the
17 time was to seek to achieve a network of interconnected
18 CNTs; that is [as read], a continuous network, among
19 active material particles, the inventors made the
20 unconventional discovery that discrete CNTs provide
21 major advantages, particularly when the active material
22 crystals are attached; for example, ionically or
23 covalently bonded to the surface of the CNTs via
24 oxidation."

25 Q. Okay. Great. Thank you.

1 So based on what you just read there in
2 paragraph 67, is it your view that active material
3 crystals can be attached either ionically or covalently
4 to the surface of oxidized carbon nanotubes? Right?

5 MR. ZINDA: Objection.

6 THE WITNESS: That's what it says, and it is
7 not something that is infeasible, but I haven't formed
8 an opinion as to -- as to the extent of feasibility.
9 But from reading it, that's what it says.

10 BY MR. IN:

11 Q. And starting with that second part there,
12 covalently bonded, what would cause the active material
13 crystals to become covalently bonded to the surface of
14 oxidized carbon nanotubes?

15 MR. ZINDA: Objection. Form.

16 THE WITNESS: Okay. The active material
17 particle can have some -- some reactive sites or bonds,
18 or --

19 (Court reporter requested clarification.)

20 THE WITNESS: I think I said dangling bonds,
21 and then the CNT has not only a functional group but
22 also possibility of some dangling bonds.

23 And so it's possible for the bonds on the two
24 parties to come together and form a covalent bond.

25

1 BY MR. IN:

2 Q. And that is something that could happen
3 between active material crystals and the surface of
4 oxidized carbon nanotubes; is that right?

5 MR. ZINDA: Objection. Form.

6 THE WITNESS: It is possible. As I said, it
7 depends on the chemistry of the surface of either party.

8 BY MR. IN:

9 Q. And same question for the first part of that
10 sentence regarding ionically bonded.

11 What would cause the active material crystals
12 to become ionically bonded to the surface of oxidized
13 carbon nanotubes?

14 MR. ZINDA: Objection. Form.

15 THE WITNESS: Well, again, these bonds, such
16 as the dangling bonds, kind of stick out from either
17 party, and there can be a charge associated with the end
18 of that bond. As a result, the bonds of the two parties
19 can come together ionically to form an ionic bond.

20 BY MR. IN:

21 Q. Besides ionic and covalent bonding, are you
22 aware of any other bonding mechanisms that could help
23 attach active materials to the surface of oxidized
24 carbon nanotubes?

25 A. Ionic bonding and covalent bonding are what's

1 known as primary bonding types. Those are the strong
2 ones.

3 Metallic bonding is another strong one, but
4 that's not really relevant here since the active
5 material is not really a conductor with a lot of free
6 electrons.

7 So -- but ionic bonding and covalent bonding
8 and metallic bonding are the three types of primary
9 bonding.

10 But then there is secondary bonding, which is
11 much weaker than any of the primary bonding types. And
12 the secondary bonding is Van der Waals sources, although
13 there are gradations of different degrees of the bonding
14 force. Among the category of -- within the category of
15 Van der Waals force of bonding.

16 So what I'm saying is that Van der Waals
17 forces, that's another bonding type that is feasible.

18 Q. Do you recall if the '483 patent mentions
19 Van der Waals bonding?

20 A. I -- it seems not. It seems that there's no
21 mention of Van der Waals.

22 Q. And going back to the types of primary bonding
23 that you mentioned earlier, is chemical bonding a type
24 of primary bonding mechanism?

25 MR. ZINDA: Objection. Form.

1 THE WITNESS: Chemical bonding is the umbrella
2 term which covers both primary bonding and secondary
3 bonding.

4 BY MR. IN:

5 Q. And are both ionic and covalent bonding then
6 types of chemical bonding?

7 A. Yes, because they are under primary bonding,
8 and both primary and secondary bonding are under the
9 umbrella called "chemical bonding."

10 Q. Going back to your description earlier just
11 regarding ionic bonding, when there is ionic bonding
12 between active materials and the surface of oxidized
13 carbon nanotubes, does that mean there is an
14 electrostatic charge on the surface of the nanotubes?

15 MR. ZINDA: Objection. Form.

16 THE WITNESS: It means that there is a charged
17 end -- a charged end. Let's say a certain bond, and the
18 end of that is -- is negative or positive, you know.
19 That's what I mean by "charged end."

20 BY MR. IN:

21 Q. And for oxidized carbon nanotubes of the type
22 discussed in the '483 patent, would you expect those
23 charged ends to be negative or positive?

24 MR. ZINDA: Objection. Form.

25 THE WITNESS: It really depends on the surface

1 chemistry, like how the functionalization is performed
2 and also whether the -- say the oxidation of
3 functionalization process causes some degradation of the
4 bonds that's already there that's causing dangling
5 bonds. So it really depends on the details of the
6 surface chemistry of either party.

7 Maybe you can ask the question again. I'm not
8 remembering exactly what you asked.

9 BY MR. IN:

10 Q. Yeah, it was a pretty simple question,
11 Dr. Chung.

12 So basically in ionic bonding between active
13 materials and oxidized carbon nanotubes, I was just
14 asking about whether the charge on the surface of the
15 nanotubes would be negative or positive.

16 MR. ZINDA: Objection. Form.

17 THE WITNESS: Yeah. It could be positive or
18 negative, depending on the surface chemistry.

19 BY MR. IN:

20 Q. Okay. Great. Thank you.

21 And if we go down just a few paragraphs in
22 your declaration to paragraph 71. That is on page 39.

23 A. Yes.

24 Q. So there you are referring to various examples
25 from the specification of the '483 patent. And in the

1 fourth line there, you mention that "active material can
2 chemically attach to the added functional groups."

3 Do you see that?

4 A. Yes.

5 Q. So am I understanding correctly that this
6 chemical attachment is referring to primary bonding that
7 can include both ionic and covalent bonding; is that
8 right?

9 MR. ZINDA: Objection. Form.

10 THE WITNESS: Well, this particular sentence
11 that you're referring to doesn't say which type of
12 bonding type. It just says "chemically attached."

13 As I said earlier, chemical bonding is a big
14 umbrella, and that includes both primary and secondary
15 bonding.

16 BY MR. IN:

17 Q. Does chemical bonding include Van der Waals
18 bonding?

19 A. Yes. As I said, chemical bonding is a big
20 umbrella.

21 Q. So what type of bonding would fall outside of
22 chemical bonding in the context of carbon nanotubes and
23 active materials?

24 MR. ZINDA: Objection. Form.

25 THE WITNESS: The -- in general, you -- I

1 think Van der Waals forces cover it -- cover even
2 physical kind of interaction. Let's say you have A on
3 top of B and -- just physically A on top of B, but
4 there's bound to be Van der Waals forces between A and
5 B.

6 So even if you say that there's no physical
7 kind of thing, one on top of the other, there has to be
8 still Van der Waals forces involved.

9 BY MR. IN:

10 Q. So are there any examples of bonding that you
11 would consider to be not chemical bonding?

12 MR. ZINDA: Objection. Form.

13 THE WITNESS: If you have a party, a third
14 party in between the A and B, the third party is like a
15 glue. That is a different situation. But in the
16 context of this patent, the attaching means touching,
17 not having a third party in between.

18 But if you include the scenario of having a
19 third party in between, then, you know, there can be
20 other kinds of linkage.

21 BY MR. IN:

22 Q. Would mechanical bonding be a type of
23 nonchemical bonding?

24 MR. ZINDA: Objection. Form.

25 THE WITNESS: Mechanical bonding can occur.

1 Say you have two surfaces that are contacting one
2 another, but there is surface undulation on the two
3 parties, and so there's mechanical interlocking, you
4 know. And you can call it mechanical bonding, but
5 that's not -- not necessarily called mechanical bonding.
6 It's just mechanical interlocking.

7 BY MR. IN:

8 Q. Okay. Understood.

9 Stay in your declaration. Let's now go
10 back -- or go forward a bit to page 92, paragraph 160.

11 A. Yes, I got it.

12 Q. So I believe here you are providing your
13 opinions regarding the Ohata-Kavan combination.

14 A. Yes.

15 Q. And there, third line of that paragraph, you
16 mention that, "Specifically, the bond between the
17 oxidized carbon nanotubes and resin would be Van der
18 Waals forces."

19 Do you see that?

20 A. Okay.

21 Q. Was that a yes?

22 A. Yes, I see it.

23 Q. Okay. What -- what is your basis there for
24 saying that the bonds between those two elements is
25 definitively Van der Waals forces?

1 A. That is because of the absence of any of the
2 primary bonding types. So what's left is the secondary
3 bonding, which is Van der Waals forces.

4 Q. And what do you mean by the "absence of any of
5 the primary bonding types"?

6 A. That is the absence of covalent, ionic, or
7 metallic bonding.

8 Q. And how are you able to come to that
9 conclusion?

10 A. Okay. Now, Van der Waals forces are all due
11 to what's called dipole-dipole interaction. By dipole,
12 I mean electric dipole, like that provided by a polar
13 bond. You have a Delta positive -- Delta plus/Delta
14 minus N, and that's called a polar bond, and that gives
15 an electric dipole.

16 And the other party also has an electric
17 dipole, and so you have electrostatic interaction
18 between these two dipoles, and that is called the
19 dipole-dipole interaction. And all Van der Waals forces
20 are due to dipole-dipole interaction. And that is
21 feasible for this particular scenario.

22 Q. When you say "feasible," do you mean that
23 other types of bond is also feasible?

24 MR. ZINDA: Objection.

25 THE WITNESS: No. I mean the Van der Waals

1 forces, that is feasible. And I already said it's the
2 absence of the other, absence of the primary bonding
3 types.

4 BY MR. IN:

5 Q. Okay. So covalent or ionic bonding would not
6 be feasible between resin and active materials; is that
7 right?

8 MR. ZINDA: Objection. Form.

9 THE WITNESS: You're talking about oxidized
10 CNT and resin, aren't you?

11 BY MR. IN:

12 Q. That's right.

13 A. Okay. Not the active material. That's the
14 next sentence. You're still talking about oxidized CNT
15 and resin, right?

16 (Court Reporter requested clarification.)

17 A. Yeah, this particular sentence has two parts
18 in it. The first part is the bond between the oxidized
19 CNT and resin; and the second part is the bond between
20 active material and resin.

21 And I'm a little confused as to which part of
22 this sentence is being discussed right now.

23 Q. Yeah. That's fair, and that's on me. So let
24 me try again, Dr. Chung.

25 So starting with the first part of that

1 sentence where you are discussing the type of bond
2 between the oxidized CNTs and resin, your view is that
3 covalent or ionic-type bonding would not be possible,
4 but that Van der Waals forces is feasible; is that
5 right?

6 MR. ZINDA: Objection. Form.

7 THE WITNESS: Yes. The -- the resin as
8 usually use, you know -- I don't mean some very fancy
9 unusual resin. But the resin as usually used, as in
10 this particular case, those are molecules. And the
11 molecules have an ion atom of carbon atom chains, and
12 its covalent bonding within that chain.

13 And all of the valance electrons of each
14 carbon atom are engaged in those covalent bonds within
15 that carbon atom chain of that polymer molecule.

16 So there is no other electron available for
17 this molecule in the resin to engage in other types of
18 primary bonding, whether covalent or ionic. The
19 electrons -- I mean the valance electrons are already
20 fully engaged. So there's no electron left behind to do
21 other kinds of engagement as necessary for the -- for
22 having ionic or covalent bonding between the resin and
23 something else.

24 BY MR. IN:

25 Q. The same question about the second part of

1 that sentence talking about the bond between the active
2 material and the resin.

3 Your view is that covalent or ionic-type
4 bonding would not be feasible between the active
5 material and the resin; is that right?

6 MR. ZINDA: Objection. Form.

7 THE WITNESS: Yeah, it's the same logic. The
8 resin, again, has all its valence electrons engaged.
9 And so no electron left behind to do this bonding with
10 the active material. I mean, by "bonding," I mean ionic
11 or covalent bonding with this active material.

12 BY MR. IN:

13 Q. Okay. And hypothetically, if there were
14 oxidized carbon nanotubes here that were not covered by
15 the resin, then would it be possible to have ionic or
16 covalent bonding between the surface of the oxidized
17 carbon nanotubes and the active materials?

18 MR. ZINDA: Objection. Form.

19 THE WITNESS: As I explained before, it may be
20 possible, but it depends on the surface chemistry of
21 either party.

22 BY MR. IN:

23 Q. So what about the surface chemistry would make
24 it be an ionic bonding as opposed to a covalent bonding?

25 MR. ZINDA: Objection. Form.

1 THE WITNESS: For ionic bonding, there needs
2 to be an appreciable, either positive or negative,
3 charged end sticking out so as to engage in this
4 electrostatic interaction with the other party, which
5 hopefully also has certain charged end sticking out.

6 Okay. And for covalent bonding, it's -- it's
7 not electrostatic; rather, it has to do with the valence
8 electrons wanting to be shared between the two parties.
9 And by sharing, I mean the electron clouds merge
10 together as if they are shared, as if these electrons
11 are shared between the two parties.

12 And the -- the driving force for that sharing
13 of electrons, which constitute the formation of the
14 covalent bond, is that the energy, or more exactly the
15 free energy -- the free energy is reduced through that
16 sharing, and that's why that sharing becomes feasible;
17 that is, it occurs on its own, what they call
18 spontaneously.

19 Okay. So it really depends on the surface
20 chemistry as to whether it's ionic bonding or covalent
21 bonding.

22 BY MR. IN:

23 Q. If the active materials that we had were LFP,
24 would you expect that to bond via covalent or ionic
25 bonding to the surface of the oxidized carbon nanotubes,

1 or do you need more information?

2 MR. ZINDA: Objection. Form.

3 THE WITNESS: As I said, it depends on the
4 surface chemistry of the two parties. And just saying
5 LFP, you know, that's just the overall composition of
6 that -- that material; that -- what's the surface
7 chemistry, that really is important in dictating the
8 type of interaction that this material can have with
9 something else.

10 BY MR. IN:

11 Q. If that LFP active material in the example I
12 just provided, if I were to tell you that there were
13 positively charged metal ions at the surface of that
14 active material, would that lead to ionic bonding with
15 the oxidized carbon nanotube surface?

16 MR. ZINDA: Objection. Form.

17 THE WITNESS: If you have some metal ions kind
18 of -- yeah, lying on the surface of this LFP, those ions
19 would look -- let's say they're positive ions -- they
20 would look for a negative charge somewhere in its
21 vicinity to interact electrostatically.

22 However, the electrostatic interaction in
23 ionic bonding is very significant compared to the
24 electrostatic interaction in Van der Waals forces.
25 Because in ionic bonding, it requires actual electron

1 transfer. Okay? It's -- it's a lot more than what --
2 the dipole-dipole interaction that I mentioned. You
3 need to have the electron transfer so that you have
4 positive charge and negative charge formed because of
5 that electron transfer. And as a result, you have
6 Coulomb, or electrostatic force between the two.

7 So the requirement of ionic bonding in terms
8 of electrostatic force and a degree of charge involved
9 is a lot more than Van der Waals forces.

10 And that's why I talked about Delta plus/Delta
11 minus when I talked about a polar bond and the electric
12 dipole resulting from that polar bond. Delta plus/Delta
13 minus means it's just a little plus, a little minus, you
14 know. And -- and such electric dipoles with a little
15 plus and a little minus is what is involved in the
16 Van der Waals forces.

17 But ionic bonding is not just Delta plus/Delta
18 minus. It's really a plus and a minus. And that --
19 that is a lot more stringent than the Delta plus/Delta
20 minus in the electric dipole and the dipole-dipole
21 interaction that constitute Van der Waals forces.

22 BY MR. IN:

23 Q. And when you say it is more stringent, what do
24 you mean by that? What does "more stringent" mean?

25 A. Stringent refers to how -- is it a Delta

1 plus/Delta minus, or is it really a plus and a minus,
2 you know? That -- what I mean by being stringent. That
3 charge has to be very well defined, not just Delta plus.

4 Q. Okay. Understood.

5 MR. IN: So with that, Counsel, I think we can
6 pass the witness.

7 Thank you, Dr. Chung.

8 MR. ZINDA: Okay. Can you give me just five
9 minutes. I don't really have -- I'd like to get on the
10 record just a highlighting issue just to get --

11 MR. IN: Sure.

12 MR. ZINDA: -- just to clarify that. I want
13 to make sure there is no confusion about that.

14 EXAMINATION BY MR. ZINDA:

15 Q. Dr. Chung, prior to the deposition today, you
16 noticed that there was highlighting on LGES-1001 in this
17 proceeding; is that correct?

18 A. Yes.

19 Q. Do you know where that highlighting came from?

20 A. Actually, I don't.

21 Q. Do you have any idea what that highlighting
22 means?

23 A. Yeah. It just highlights certain words. It's
24 not clear to me what -- the principle behind the choice
25 of words to be highlighted.

1 Q. Let me rephrase it.

2 Do you have any idea behind the purpose of the
3 highlighting in the LGES-1001?

4 A. I -- I really don't have insight as to why
5 that person doing the highlighting is doing that. I
6 hate to guess.

7 Q. I'm not asking you to speculate.

8 And one other question I have for you is: Did
9 anybody, other than today when we talked about that
10 highlighting with opposing counsel, has anybody ever
11 discussed that highlighting with you?

12 A. No.

13 Q. Okay. And you mentioned earlier, before the
14 deposition, that you thought there might have been
15 highlighting on another Exhibit 1001 in an earlier
16 proceeding you testified on; is that correct?

17 A. Yes. And I did mention to the opposing
18 counsel in that particular declaration, and he didn't
19 say anything. Pretty much he didn't say anything after
20 that.

21 Q. That's fine. I'm just going to ask you: Did
22 all of the -- your testimony about the highlighting in
23 this case, that would apply equally to the highlighting
24 in all of the other depositions, correct?

25 A. Yes.

THE SULLIVAN GROUP OF COURT REPORTERS

1 MR. ZINDA: Okay. I have no further
2 questions.

3 MR. IN: Okay. Nothing further from
4 Petitioner either.

5 COURT REPORTER: Thank you, Counsel.
6 May I get transcript requests on the record,
7 please?

8 MR. ZINDA: We do not -- patent owner does not
9 need a transcript.

10 COURT REPORTER: Okay. Thank you.

11 MR. IN: Standing instructions for us. Rough
12 is fine.

13 (Whereupon the proceedings concluded at
14 10:58 a.m.)

15

16

17

18

19

20

21

22

23

24

25

THE SULLIVAN GROUP OF COURT REPORTERS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

ERRATA SHEET

NAME OF CASE: LGES v. MODULAR REBAR DESIGN
DATE OF DEPOSITION: JULY 2, 2025
NAME OF WITNESS: DEBORAH D.L. CHUNG, Ph.D.

Reason Codes:

- 1:** To clarify the record.
- 2:** To conform to the facts.
- 3:** To correct transcription error.

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Page _____ **Line** _____ **Reason** _____
From _____ **to** _____

Deponent's Signature _____
Date _____

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

DECLARATION UNDER PENALTY OF PERJURY

I, DEBORAH D.L. CHUNG, Ph.D., do hereby
certify under penalty of perjury that I have read the
foregoing transcript of my deposition taken on
July 2, 2025; that I have made such corrections as
appear noted on the Deposition Errata Page(s), attached
hereto, signed by me; that my testimony as contained
herein, as corrected, is true and correct.

This Declaration is executed this _____ day
of _____, 20____, at _____,
California.

DEBORAH D.L. CHUNG, Ph.D.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25

**I, Tamara Houston, RPR, CCRR, CSR No. 7244, a
Certified Shorthand Reporter in the State of California,
duly empowered to administer oaths, do hereby certify:**

That said deposition was taken down by me in shorthand at the time and place therein named, and thereafter reduced to typewriting by computer-aided transcription under my direction;

I further certify that I am not interested in the event of the action.

Dated: 2nd of July, 2025.

TAMARA L. HOUSTON
CSR 7244, RPR, CCRR 140

THE SULLIVAN GROUP OF COURT REPORTERS

-	6	apply 30:23	bonded 13:23 14:12,13 15:10,12
--o0o- 6:2	6 12:5	appreciable 26:2	bonding 15:21,22,25 16:1,3,7,8,9,10,11,12,13,15,17,19,22,23,24 17:1,2,3,5,6,7,8,9,11 18:12 19:6,7,12,13,15,17,18,19,21,22 20:10,11,22,23,25 21:4,5 22:2,3,5,7 23:2,5 24:3,12,18,22 25:4,9,10,11,16,24 26:1,6,20,21,25 27:14,23,25 28:7,17
--o0o-- 6:5,9	67 13:6,7,8,13 14:2	articles 12:1	bonds 14:17,20,22,23 15:15,16,18 18:4,5 21:24 24:14
1	7	atom 24:11,14,15	bound 20:4
1001 7:8 8:16 30:15	71 18:22	attach 15:23 19:2	briefly 13:10
10:06 6:1	72 12:7	attached 13:22 14:3 19:12	
10:58 31:14	7244 6:4	attaching 20:16	
13 12:7	9	attachment 19:6	
160 21:10	92 21:10	attention 7:24	
2	A	aware 11:4 15:22	
2 6:1	a.m. 6:1 31:14	B	C
2006 10:11	absence 22:1,4,6 23:2	back 16:22 17:10 21:10	California 6:4
2025 6:1	abstract 13:4	background 6:24	call 21:4 26:17
3	accepted 9:23,25 10:7	based 14:1	called 6:7 17:9 21:5 22:11,14,18
36 13:6,8	achieve 13:17	basically 8:20 18:12	carbon 14:4,14 15:4,13,24 17:13,21 18:13 19:22 21:17 24:11,14,15 25:14,17 26:25 27:15
39 18:22	active 13:19,21 14:2,12,16 15:3,11,23 16:4 17:12 18:12 19:1,23 23:6,13,20 25:1,4,10,11,17 26:23 27:11,14	basis 21:23	case 6:13 24:10 30:23
4	actual 27:25	bearing 6:21	category 16:14
426 11:3	added 19:2	beginning 9:4	causing 18:4
483 7:7,15,25 8:19 16:18 17:22 18:25	advantages 13:21	bit 8:10 21:10	Certified 6:4
	applied 9:25	bond 14:24 15:18,19 17:17 21:16 22:13,14,23 23:18,19 24:1 25:1 26:14,24 28:11,12	chain 24:12,15

THE SULLIVAN GROUP OF COURT REPORTERS

chains 24:11	compared 27:23	11,16,24 26:6,14,20,24	29:15 30:14
charge 15:17 17:14 18:14 27:20 28:4,8 29:3	composition 27:5	covalently 13:23 14:3,12,13	depositions 30:24
charged 17:16,17,19,23 26:3,5 27:13	computer 8:1	cover 20:1	der 16:12,15,16,19,21 19:17 20:1,4,8 21:17,25 22:3,10,19,25 24:4 27:24 28:9,16,21
chemical 16:23 17:1,6,9 19:6,13, 17,19,22 20:11	concluded 7:11 31:13	covered 25:14	description 17:10
chemically 19:2,12	conclusion 22:9	covers 17:2	details 18:5
chemistry 15:7 18:1,6,18 25:20,23 26:20 27:4,7	conductor 16:5	crystals 13:22 14:3,13 15:3,11	dictating 27:7
choice 29:24	confused 23:21	D	dipole 22:11,12,15,17 28:12, 20
choppy 8:10	confusion 29:13	D.L. 6:18	dipole-dipole 22:11,19,20 28:2,20
Chung 6:6,11,18 7:25 8:14 9:22 10:10 11:1 12:18 13:15 18:11 23:24 29:7, 15	considered 11:7,25	dangling 14:20,22 15:16 18:4	dipoles 22:18 28:14
claim 9:6,12	constitute 26:13 28:21	Deborah 6:6,18	direct 7:24
claims 8:22,25 9:2 10:2	contacting 21:1	dec 7:14	discovery 13:20
clarification 14:19 23:16	context 19:22 20:16	declaration 7:14 10:2,6,11,20,24 11:19 12:5,8,13,24 13:6 18:22 21:9 30:18	discrete 13:20
clarify 29:12	continuous 13:18	defined 29:3	discuss 7:22
clean 10:13	conventional 13:16	definitively 21:25	discussed 17:22 23:22 30:11
clear 12:18 29:24	copy 10:13	degradation 18:3	discussing 24:1
clouds 26:9	correct 8:3 29:17 30:16,24	degree 28:8	discussions 6:24
CNT 14:21 23:10,14,19	correctly 19:5	degrees 16:13	document 8:16,22 10:16
CNTS 13:18,20,23 24:2	Coulomb 28:6	Delta 22:13 28:10,12,17,19, 25 29:3	documents 7:13 10:22 11:4,7,9,10, 20,23
combination 21:13	counsel 7:17,18,20 29:5 30:10, 18 31:5	depending 18:18	driving 26:12
	court 6:3 14:19 23:16 31:5,10	depends 15:7 17:25 18:5 25:20 26:19 27:3	due 22:10,20
	covalent 14:24 15:21,25 16:7 17:5 19:7 22:6 23:5 24:3,12,14,18,22 25:3,	deposition 6:20 7:11,12 10:17	

THE SULLIVAN GROUP OF COURT REPORTERS

dwell 9:3 E earlier 16:23 17:10 19:13 30:13,15 electric 22:12,15,16 28:11,14, 20 electron 24:16,20 25:9 26:9 27:25 28:3,5 electrons 16:6 24:13,19 25:8 26:8,10,13 electrostatic 17:14 22:17 26:4,7 27:22,24 28:6,8 electrostatically 27:21 elements 21:24 end 15:17 17:17,18,19 26:3, 5 ends 17:23 energy 6:12 26:14,15 engage 24:17 26:3 engaged 24:14,20 25:8 engagement 24:21 equally 30:23 EXAMINATION 6:10 29:14 examples 18:24 20:10 exhibit 7:8 8:16 10:11 11:6,13 30:15	exhibits 10:23 11:2,15,16,18,20 12:17,19 expect 17:22 26:24 explained 25:19 extent 14:8 F face 9:19,21 fair 8:18 9:5,12 10:2 23:23 fall 19:21 fancy 24:8 feasibility 14:8 feasible 16:17 22:21,22,23 23:1, 6 24:4 25:4 26:16 Figure 12:7 filing 11:14 filings 11:24 fine 30:21 31:12 force 16:14,15 26:12 28:6,8 forces 16:17 20:1,4,8 21:18,25 22:3,10,19 23:1 24:4 27:24 28:9,16,21 form 9:7 10:4 11:17 14:15,24 15:5,14,19 16:25 17:15, 24 18:16 19:9,24 20:12, 24 23:8 24:6 25:6,18,25 27:2,16 formation 26:13	formed 14:7 28:4 forward 21:10 found 12:9,11,23 fourth 19:1 free 16:5 26:15 full 6:16 fully 24:20 functional 14:21 19:2 functionalization 18:1,3 G general 19:25 give 7:3 29:8 glue 20:15 Good 6:11,15 gradations 16:13 Great 6:19 13:25 18:20 group 14:21 groups 19:2 guess 11:15 30:6 H happen 15:2 hate 30:6	hear 8:11 hearing 8:8 highlighted 29:25 highlighting 29:10,16,19,21 30:3,5, 10,11,15,22,23 highlights 29:23 Houston 6:3 hypothetically 25:13 Hyun 6:11 I idea 29:21 30:2 important 9:13,15 27:7 include 11:5 12:23 19:7,17 20:18 includes 19:14 infeasible 14:7 information 7:16,17 27:1 insight 30:4 instance 12:7 instructions 31:11 interact 27:21 interaction 20:2 22:11,17,19,20 26:4 27:8,22,24 28:2,21 interconnected 13:17
---	--	---	--

THE SULLIVAN GROUP OF COURT REPORTERS

interlocking 21:3,6 inventors 13:19 involved 20:8 28:8,15 ion 24:11 ionic 15:19,21,25 16:7 17:5, 11 18:12 19:7 22:6 23:5 24:18,22 25:10,15,24 26:1,20,24 27:14,23,25 28:7,17 ionic-type 24:3 25:3 ionically 13:22 14:3 15:10,12,19 ions 27:13,17,18,19 issue 29:10 J Jin 6:11 journal 12:2 JULY 6:1 K kind 7:16 15:16 20:2,7 27:17 kinds 20:20 24:21 L lead 27:14 left 22:2 24:20 25:9 LFP 26:23 27:5,11,18	LG 6:12 11:20,23 LG's 11:13 LGES 11:12,16 LGES-1001 29:16 30:3 linkage 20:20 list 11:2,6 listed 10:23 11:11,13,19,23 12:4 listing 12:22 literature 12:1,3,6,9,12,21 logic 25:7 looked 13:3 lot 13:3 16:5 28:1,9,19 loud 13:15 lying 27:18 M made 13:19 main 7:13 major 13:21 make 25:23 29:13 material 13:19,21 14:2,12,16 15:3,11 16:5 19:1 23:13,20 25:2,5,10,11 27:6,8,11,14	materials 6:24 10:19 11:5 15:23 17:12 18:13 19:23 23:6 25:17 26:23 meaning 9:18,20,21,24 10:7 meanings 10:1 means 9:11 17:16 20:16 28:13 29:22 mechanical 20:22,25 21:3,4,5,6 mechanism 16:24 mechanisms 15:22 meet 7:22 memory 13:12 mention 12:12 16:21 19:1 21:16 30:17 mentioned 16:23 28:2 30:13 mentions 16:18 merge 26:9 metal 27:13,17 metallic 16:3,8 22:7 micrograph 12:8 minus 22:14 28:11,13,15,18, 20 29:1 minutes 29:9 molecule 24:15,17 molecules 24:10,11	morning 6:11,14 7:4,19 MRD 10:11 11:16 MRD's 11:23 N nanotube 27:15 nanotubes 14:4,14 15:4,13,24 17:13,14,21 18:13,15 19:22 21:17 25:14,17 26:25 necessarily 21:5 negative 17:18,23 18:15,18 26:2 27:20 28:4 network 13:17,18 nonchemical 20:23 noticed 29:16 number 6:4 7:15 O Object 10:4 Objection 9:7 11:17 14:5,15 15:5, 14 16:25 17:15,24 18:16 19:9,24 20:12,24 22:24 23:8 24:6 25:6, 18,25 27:2,16 occur 20:25 occurs 26:17 Ohata-kavan 21:13 opinion
---	---	---	--

THE SULLIVAN GROUP OF COURT REPORTERS

14:8	pass 29:6	primary 16:1,8,11,22,24 17:2,7, 8 19:6,14 22:2,5 23:2 24:18	6:19
opinions 21:13	past 6:21,23	principle 29:24	reason 7:3
opposed 25:24	patent 7:7,15,25 8:3,5,13,19, 22 11:11 16:18 17:22 18:25 20:16 31:8	prior 29:15	recall 10:19 11:9,22 16:18
opposing 30:10,17	performed 12:6,21 18:1	proceeding 29:17 30:16	record 6:17 12:20 13:1 29:10 31:6
owner 31:8	person 30:5	proceedings 12:20 31:13	reduced 26:15
oxidation 13:24 18:2	Petitioner 6:12 31:4	process 12:2 18:3	references 12:22
oxidized 14:4,14 15:4,12,23 17:12,21 18:13 21:17 23:9,14,18 24:2 25:14, 16 26:25 27:15	Ph.d. 6:6	provide 13:20	referring 11:1 18:24 19:6,11
	photos 12:15,16	provided 7:17 11:20 22:12 27:12	refers 28:25
P	physical 20:2,6	providing 21:12	reflects 10:6
pages 12:5	physically 20:3	publications 13:2	refresh 13:12
paper 12:9	plus/delta 22:13 28:10,12,17,19 29:1	pull 10:10	related 7:7
papers 11:4 12:2,3,4,11 13:1	point 10:25	purpose 30:2	relevant 12:2 16:4
paragraph 13:6,8,11,13 14:2 18:22 21:10,15	polar 22:12,14 28:11,12	putting 10:20	relied 10:20 11:8,15,18
paragraphs 18:21	polymer 24:15		remembering 18:8
part 10:2 11:6 12:19,24 14:11 15:9 23:18,19,21, 25 24:25	positive 17:18,23 18:15,17 22:13 26:2 27:19 28:4	Q	rephrase 30:1
particle 14:17	positively 27:13	question 12:25 15:9 18:7,10 24:25 30:8	reporter 6:3,4 14:19 23:16 31:5, 10
particles 13:19	possibility 14:22	questions 7:7 31:2	represent 6:12
parties 14:24 15:18 21:3 26:8, 11 27:4	prepare 7:12		requested 14:19 23:16
parts 23:17	preparing 10:16	R	requests 31:6
party 15:7,17 18:6 20:13,14, 17,19 22:16 25:21 26:4	pretty 9:3 18:10 30:19	reactive 14:17	requirement 28:7
		read 13:12,15,18 14:1	requires 27:25
		reading 14:9	resin
		realize	

THE SULLIVAN GROUP OF COURT REPORTERS

21:17 23:6,10,15,19,20 24:2,7,9,17,22 25:2,5,8, 15	significant 27:23	suppose 9:16	track 13:4
result 15:18 28:5	simple 18:10	surface 13:23 14:4,13 15:3,7, 12,23 17:12,14,25 18:6, 14,18 21:2 25:16,20,23 26:19,25 27:4,6,13,15, 18	transcript 31:6,9
resulting 28:12	sites 14:17	surfaces 21:1	transfer 28:1,3,5
results 12:5	situation 20:15	sworn 6:8	trouble 8:8
review 8:4,25 9:2 10:1,16	skip 6:23		truthful 7:4
reviewed 7:13,16 8:3,5,13 10:5 11:5 12:23	Solutions 6:12		type 16:17,23 17:21 19:11, 12,21 20:22 24:1 27:8
Rough 31:11	sources 16:12	T	types 16:1,8,11,22 17:6 22:2, 5,23 23:3 24:17
S	Specifically 21:16	talked 28:10,11 30:9	U
scenario 20:18 22:21	specification 18:25	talking 23:9,14 25:1	ultimately 12:23
scientific 9:24 10:1,7	specs 8:15	Tamara 6:3	umbrella 17:1,9 19:14,20
search 12:1,3,6,10,12,21 13:2	speculate 30:7	term 9:24 17:2	unconventional 13:20
secondary 16:10,12 17:2,8 19:14 22:2	spontaneously 26:18	terms 9:12,13,15,18 10:1,8 28:7	understand 7:9 8:18 9:5,8,11,16,18
seek 13:17	Standing 31:11	testified 6:8 30:16	understanding 10:7 19:5
SEM 12:8	starting 14:11 23:25	testimony 7:4 30:22	Understood 21:8 29:4
sentence 13:11,13 15:10 19:10 23:14,17,22 24:1 25:1	state 6:16	thing 20:7	undulation 21:2
session 7:18	Stay 21:9	thought 30:14	unmarked 10:13
shared 26:8,10,11	stick 15:16	time 13:17	unusual 24:9
sharing 26:9,12,16	sticking 26:3,5	title 13:3	V
short 7:18	stringent 28:19,23,24,25 29:2	today 7:4,6 29:15 30:9	valance 24:13,19
Shorthand 6:4	strong 16:1,3	today's 7:12 10:17	valence 25:8 26:7
	submitted 11:15,16	top 20:3,7	Van 16:12,15,16,19,21
	summarizing 7:17	touching 20:16	

THE SULLIVAN GROUP OF COURT REPORTERS

19:17 20:1,4,8 21:17,25 22:3,10,19,25 24:4 27:24 28:9,16,21 vicinity 27:21 view 14:2 24:2 25:3 W Waals 16:12,15,16,19,21 19:17 20:1,4,8 21:18,25 22:3,10,19,25 24:4 27:24 28:9,16,21 wanted 13:10 wanting 26:8 weaker 16:11 WEDNESDAY 6:1 week 6:21 wisdom 13:16 words 8:6 9:17 29:23,25 wrote 10:6 Y yesterday 7:11 Z Zinda 7:20 8:10 9:7 10:4 11:17 14:5,15 15:5,14 16:25 17:15,24 18:16 19:9,24 20:12,24 22:24 23:8 24:6 25:6,18,25 27:2,16 29:8,12,14 31:1,8 Zoom 7:18		
---	--	--