

In the Matter Of:

LG ENERGY SOLUTION vs MOLECULAR REBAR DESIGN

IPR2024-01006

YU ZHU

August 12, 2025



ESQUIRE
Page 1 of 21 SOLUTIONS

800.211.DEPO (3376)
EsquireSolutions.com

MRD EX. 2044
LGES v MRD
IPR2024-01013

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

LG ENERGY SOLUTION LTD)(
SAMSUNG ELECTRONICS CO LTD)(
SAMSUNG ELECTRONICS AMERICA INC)(
Petitioner,)(
VS.)(
MOLECULAR REBAR DESIGN LLC)(
Patent Owner.)(
(CASE IPR2024-01006
(U.S. PATENT 8,808,909

ORAL DEPOSITION OF

YU ZHU

August 12, 2025

(Reported Remotely)

ORAL DEPOSITION OF YU ZHU, produced as
a witness at the instance of the Patent Owner, and
duly sworn, was taken in the above-styled and numbered
cause on the 12th day of August, 2025, from 9:02 a.m.
to 9:32 a.m., before BROOKE SAWYER, CSR, in and for
the State of Texas, reported by oral stenograph, at
Akron, Ohio, pursuant to the Federal Rules of Civil
Procedure and the provisions stated on the record or
attached herein.

A P P E A R A N C E S

FOR THE PETITIONER:

HYUN JIN IN (Appeared Remotely)
FISH & RICHARDSON PC
1000 Maine Avenue Southwest, Suite 1000
Washington, D.C. 20024
ptabinbound@fr.com

FOR THE PATENT OWNER:

STEPHEN ZINDA (Appeared Remotely)
CABELLO HALL ZINDA PLLC
801 Travis Street, Suite 1610
Houston, Texas 77030
stephen@chzfirm.com

ALSO PRESENT: (Appeared Remotely)

GRETCHEN A. DEVRIES, Paralegal

DANIEL JANG, Paralegal

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 N D E X	
	PAGE
Appearances	2
YU ZHU	
Examination by Mr. Zinda	4
Examination by Mr. In	12
Reporter's Certificate	16
E X H I B I T S	
(None marked.)	

P R O C E E D I N G S

THE COURT REPORTER: We are on the record. Today's date is August 12th, 2025. The time is 9:02 a.m. Would counsel please state their appearance and affiliations for the record, and I will swear in the witness.

MR. ZINDA: Stephen Zinda on behalf of the patent owner, Molecular Rebar Design.

MR. IN: Hyun Jin In representing the petitioner, LG Energy Solution, joined here by Daniel Jang and Gretchen DeVries.

YU ZHU,
having been duly sworn, testified as follows:

THE COURT REPORTER: Thank you.
Counsel, you may proceed.

EXAMINATION

BY MR. ZINDA:

Q Good morning, Dr. Zhu.

A Good morning.

Q So you were deposed yesterday in the proceeding involving the 483 patent, correct?

A Yes.

Q And so I'm not going to go over the ground rules and all that. I -- I do want to ask again. Do you have any handwritten or digital notes accessible

1 to you right now? Sorry. Give me one second.

2 There's a -- there's, like, an ambulance going by my
3 office. All right. It's --

4 A Yeah. I --

5 Q -- far enough away. Did you have -- do you
6 have -- do you have any notes, whether handwritten or
7 physical, that are accessible to you right now?

8 A I have electronic version of my
9 deposition -- of my declaration. Sorry. Yeah.

10 Q Of your -- and that is your declaration in
11 the proceeding involving the 909 patent?

12 A Yes.

13 Q Okay. Anything else?

14 A Nothing else.

15 Q Okay. And some of these questions are going
16 to be familiar because I asked them yesterday, but I
17 want to make sure I have them in the transcript for
18 today since there's some overlap. So can I get you to
19 first go to LGES 1004, which is a reference that we
20 have called Ohata?

21 A Yes. Just confirm it's 1004 LGES, Ohata.
22 It's --

23 Q Correct.

24 A -- dated -- right.

25 Q Correct. Can --

1 A Yes.

2 Q -- you go to Figure 1?

3 A Yes.

4 Q And you have offered testimony that the --
5 that there are discrete carbon nanotubes in Figure
6 1(b), correct?

7 MR. IN: Objection, form.

8 A In my declaration, I have noted that carbon
9 nanotube in Figure 1(b). Exfoliated and -- yeah.
10 Exfoliated carbon nanotubes.

11 Q In Figure --

12 A More specifically, I say the discrete,
13 non-agglomerated, and the exfoliated carbon nanotubes.

14 Q Okay. And Figure 1(a) -- you would agree
15 with me that Figure 1(a) does not depict discrete
16 carbon nanotubes, correct?

17 A Yes. It is entangled carbon nanotube in
18 Figure 1(a).

19 Q And you -- would you agree with me that the
20 carbon nanotubes in Figure 1(a) are capable of being
21 separated to give individual tubes under the right
22 procedure?

23 MR. IN: Objection, form.

24 A Yeah. This depending on a lot of
25 preconditions, as I mentioned previously. The initial

1 status of carbon nanotube and the way that it
2 entangled and how the procedure is used to separate
3 those carbon nanotubes, this will affect the eventual
4 effectiveness of how those carbon nanotubes can be
5 converted to discrete, exfoliated, and un-agglomerated
6 carbon nanotubes.

7 Q But under the right procedure, entangled
8 carbon nanotubes can be made discrete, correct?

9 MR. IN: Objection, form.

10 A Under the -- under the right procedure and
11 also depending on the initial status of the carbon
12 nanotube, the -- the composite, and that is a
13 possibility as those entangled carbon nanotube can be
14 converted into discrete, exfoliated, and
15 un-agglomerated nanotube. But it is really depending
16 on the condition of the tubes and the procedure used.

17 Q And yesterday you testified that you were
18 aware of a -- of scientific principle known as
19 electron tunneling; is that right?

20 A Yes. I understand the concept.

21 Q Can you please provide your understanding of
22 electron tunneling again?

23 A Yeah. Yesterday I have already mentioned
24 electron tunneling. In fact, it's a microscopic
25 phenomenon. And it -- it happen in a very small size

1 range, which means that electrons can be transmitted
2 from one object to another object through some gap
3 typically in a vacuum status and -- however, this
4 happen usually at a very, very short distance between
5 objects.

6 Q And the objects that you're referring to are
7 conductive objects?

8 A The objects means -- in this context, the
9 objects means is they are intrinsically electronically
10 conductive objects.

11 Q What is the -- and then I believe yesterday
12 I asked you about a scientific principle known as the
13 percolation threshold. Do you remember that?

14 A Yes. I remember you asking that question.

15 Q Can you please provide me your understanding
16 of what the percolation threshold is?

17 A Yeah. As I said yesterday, the percolation
18 threshold is a percentage of a filler in composite
19 materials, and usually there is a percentage --
20 threshold percentage is volume-based percentage. So
21 if you have a filler which reach critical volume
22 percentage in composite and then the filler can see it
23 as a -- basically, a form of connected network, and
24 that this usually called percolation threshold.

25 Q And can the percolation threshold enable a

1 material that is normally nonconductive to act as a
2 conductive material?

3 A Yeah. I -- I -- I -- I -- I -- I -- I want
4 to make sure you mean the materials means the
5 composite. Right?

6 Q Correct. The composite -- yes. Does a --
7 does a percolation threshold allow a normally
8 nonconductive composite material to act as a
9 conductive material?

10 A If the percolation threshold is reached, in
11 this context, the filler is a conductive filler and,
12 as a matrix material, is nonconductive materials. And
13 if you have enough filler in this matrix material and
14 the filler is more than percentage, is above the
15 threshold of percolation threshold, the -- then the
16 composite, which is the conductive filler, and the
17 nonconductive matrix materials will become effectively
18 conductive medium as a whole.

19 Q And then yesterday I asked you about the
20 conductivity of active material used for lithium-ion
21 batteries. Do you remember that?

22 A Yes, I remember that.

23 Q I don't -- I don't want to mischaracterize
24 what you said, but I -- correct me if I'm wrong, but
25 certain active materials used for lithium-ion

1 batteries can have a high electrical conductivity,
2 correct?

3 MR. IN: Objection to form.

4 A Yeah. What I said is the intrinsic
5 conductivity of active materials. For some of them,
6 they have good intrinsic conductivity.

7 Q All right. Which -- which, I assume, means
8 that for others they may not have such good intrinsic
9 conductivity?

10 A Yeah. Some not good intrinsic conductivity.

11 Q But would you consider -- would you expect
12 an active material to have the same level of
13 conductivity as an insulating material?

14 A Some active materials -- intrinsic
15 conductivity is very poor, and it can be regarded
16 as -- nearly as an insulating material.

17 Q Got it. I want to ask you if you can pull
18 out LGES 1006.

19 A That is a patent from Lee?

20 Q Lee. Right. And if I could get you to turn
21 to Figure 1 -- or, actually, let's -- let's go down
22 to -- give me one second -- paragraph 23, which is on
23 page 15 -- page 15 going off the bottom number on the
24 pages.

25 A Page 15.

1 Q Paragraph 23.

2 A Yes.

3 Q And it -- and it says there (as read):
4 Figure 1 is a schematic view of the structure of an
5 anode active material.

6 What is your understanding of what it means
7 when it says "a schematic view"?

8 MR. IN: Objection to form.

9 A Schematic view is basically the
10 representative structure provided by the author of the
11 document. It's not experimental data. It is a
12 representative view from the -- from the author of the
13 document.

14 Q Are you aware of anything in Lee that
15 teaches that Figure 1 is drawn to scale?

16 A Figure 1 is drawn to representative of the
17 view of the -- of -- of the author, which is Lee in
18 this patent, for his view about what are the relative
19 size of all the particles that -- in -- in the
20 composite.

21 Q All right. I have no further questions.

22 MR. IN: Can we take a 15-minute break?
23 I may have just a couple questions for redirect.

24 MR. ZINDA: Sure.

25 MR. IN: Would that be okay?

1 MR. ZINDA: Yep.

2 THE COURT REPORTER: We are off the
3 record at 9:14 a.m.

4 (Off the record.)

5 THE COURT REPORTER: We are on the
6 record at 9:29 a.m.

7 EXAMINATION

8 BY MR. IN:

9 Q Hi, Dr. Zhu, I just have a few questions for
10 you. Earlier today do you recall Opposing Counsel
11 asking you about Figure 1(a) of Ohata LGES 1004?

12 A Yes.

13 Q And do you recall characterizing the
14 nanotubes depicted in Figure 1(a) as being entangled?
15 Do you remember that?

16 A I remember that.

17 Q So how were you able to determine that those
18 nanotubes shown in Figure 1(a) are entangled?

19 A That is quite as Ohata just say that it is
20 put in the carbon nanotube in Figure 1(a). Tangled
21 and twisted with one another, so it was considered
22 entangled.

23 Q Okay. And also earlier today, do you recall
24 Opposing Counsel asking you about the tunneling
25 effect?

1 A Yes. I remember.

2 Q Okay. And do you recall responding that it
3 is something that can happen at -- and I quote --
4 "short distances?"

5 A Yes. I remember.

6 Q Okay. Could you explain what you -- what
7 you meant by "short distances?"

8 A Yeah. That short distance usually refers to
9 the similar size of atoms. If we -- at one point, you
10 can see the carbon atom's size, that is the short
11 distance I am referring.

12 Q Okay. So -- so that -- in the context of
13 electrode materials of lithium-ion batteries, would
14 you expect such tunneling effects to occur?

15 MR. ZINDA: Objection, form.

16 A If we consider a lithium battery, this is
17 typically microscopic device, and I don't think the
18 tunneling effect actually play any part in the role of
19 these microscopic devices.

20 Q And would you expect tunneling effects to
21 occur in lithium-ion battery electrode materials that
22 include carbon nanotubes in them?

23 MR. ZINDA: Objection, form.

24 A I -- I don't think tunneling effect is
25 important for the electrode of lithium-ion battery.

1 Same reason as I mentioned -- this is a microscopic
2 device, and tunneling effect happen at a very short
3 distance.

4 Q Okay. Thank you, Dr. Zhu.

5 MR. IN: No further questions from
6 petitioner.

7 MR. ZINDA: I have no -- I have no
8 redirect; so we can we go off the record.

9 THE COURT REPORTER: We are off the
10 record at 9:32 a.m.

11 (End of testimony at 9:32 a.m.)
12
13
14
15
16
17
18
19
20
21
22
23
24
25

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

LG ENERGY SOLUTION LTD)(
SAMSUNG ELECTRONICS CO LTD)(
SAMSUNG ELECTRONICS AMERICA INC)(
Petitioner,)(
VS.)(
MOLECULAR REBAR DESIGN LLC)(
Patent Owner.)(
(CASE IPR2024-01006
(U.S. PATENT 8,808,909

REPORTER'S CERTIFICATION
ORAL DEPOSITION OF
YU ZHU
August 12, 2025
(Reported Remotely)

I, BROOKE SAWYER, Certified Shorthand
Reporter in and for the State of Texas, hereby certify
to the following:

That the witness, YU ZHU, was duly sworn by
the officer and that the transcript of the oral
deposition is a true record of the testimony given by
the witness;

I further certify that pursuant to FRCP Rule
30(f)(1) that the signature of the deponent:

_____ was requested by the deponent or a
party before the completion of the deposition and that
the signature is to be before any notary public and
returned within 30 days from the date of receipt of
the transcript. If returned, the attached Changes and
Signature Page contains any changes and the reasons

therefor;

 X was not requested by the deponent or a party before the completion of the deposition.

I further certify that I am neither counsel for, related to, nor employed by any of the parties or attorneys in the action in which the proceeding was taken, and further that I am not financially or otherwise interested in the outcome of the action.

Certified to by me this 12th of August,
2025.



BROOKE SAWYER, TEXAS CSR 12653
Expiration Date: 01-31-2027
Esquire Deposition Solutions
Firm Registration No. 03
1235 North Loop West, Suite 510
Houston, Texas 77008
713-524-4500

1	9	appearance 4:5	carbon 4:21 6:5, 8, 10, 13, 16, 17, 20 7:1, 3, 4, 6, 8, 11, 13 12:20 13:10, 22	5:23, 25 6:6, 16 7:8 9:6, 24 10:2
1 6:2 10:21 11:4, 15, 16	909 5:11	assume 10:7		
	9:02 4:4	atom's 13:10		counsel 4:4, 15 12:10, 24
1(a) 6:14, 15, 18, 20 12:11, 14, 18, 20	9:14 12:3	atoms 13:9	characteriz ing 12:13	couple 11:23
	9:29 12:6	August 4:3	composite 7:12 8:18, 22 9:5, 6, 8, 16 11:20	COURT 4:2, 14 12:2, 5 14:9
1(b) 6:6, 9	9:32 14:10, 11	author 11:10, 12, 17		critical 8:21
1004 5:19, 21 12:11	A	aware 7:18 11:14	concept 7:20	
1006 10:18	a.m. 4:4 12:3, 6 14:10, 11	B	condition 7:16	D
12th 4:3	accessible 4:25 5:7	basically 8:23 11:9	conductive 8:7, 10 9:2, 9, 11, 16, 18	Daniel 4:10
15 10:23, 25	act 9:1, 8	batteries 9:21 10:1 13:13	conductivit y 9:20 10:1, 5, 6, 9, 10, 13, 15	data 11:11
15-minute 11:22	active 9:20, 25 10:5, 12, 14 11:5	battery 13:16, 21, 25	confirm 5:21	date 4:3
2	affect 7:3	behalf 4:7	connected 8:23	dated 5:24
2025 4:3	affiliation s 4:5	bottom 10:23	considered 12:21	declaration 5:9, 10 6:8
23 10:22 11:1	agree 6:14, 19	break 11:22	context 8:8 9:11 13:12	depending 6:24 7:11, 15
4	ambulance 5:2	C	converted 7:5, 14	depict 6:15
483 4:21	anode 11:5	called 5:20 8:24	correct	deposited 12:14
		capable 6:20		deposed 4:20
				deposition

5:9	effectivene	13:14, 20	Gretchen	
Design	ss	experimenta	4:11	J
4:8	7:4	l	ground	
determine	effects	11:11	4:23	Jang
12:17	13:14, 20	explain		4:11
device	electrical	13:6	H	Jin
13:17	10:1			4:9
14:2	electrode	F	handwritten	joined
devices	13:13, 21,		4:25 5:6	4:10
13:19	25	fact	happen	
Devries	electron	7:24	7:25 8:4	L
4:11	7:19, 22,	familiar	13:3 14:2	
digital	24	5:16	high	Lee
4:25	electronic	Figure	10:1	10:19, 20
discrete	5:8	6:2, 5, 9,	Hyun	11:14, 17
6:5, 12, 15	electronica	11, 14, 15,	4:9	level
7:5, 8, 14	lly	18, 20		10:12
distance	8:9	10:21	I	LG
8:4 13:8,	electrons	11:4, 15,		4:10
11 14:3	8:1	16 12:11,	important	LGES
distances	enable	14, 18, 20	13:25	5:19, 21
13:4, 7	8:25	filler	include	10:18
document	end	8:18, 21,	13:22	12:11
11:11, 13	14:11	22 9:11,	individual	lithium
drawn	Energy	13, 14, 16	6:21	13:16
11:15, 16	4:10	form	initial	lithium-ion
duly	entangled	6:7, 23	6:25 7:11	9:20, 25
4:13	6:17 7:2,	7:9 8:23	insulating	13:13, 21,
	7, 13	10:3 11:8	10:13, 16	25
	12:14, 18,	13:15, 23	intrinsic	lot
E	22	G	10:4, 6, 8,	6:24
	eventual	gap	10, 14	M
earlier	7:3	8:2	intrinsical	
12:10, 23	EXAMINATION	give	ly	made
effect	4:16 12:7	5:1 6:21	8:9	7:8
12:25	exfoliated	10:22	involving	make
13:18, 24	6:9, 10, 13	good	4:21 5:11	5:17 9:4
14:2	7:5, 14	4:18, 19		material
effectively	expect	10:6, 8, 10		9:1, 2, 8,
9:17	10:11			

9, 12, 13, 20 10:12, 13, 16 11:5	12:20	office 5:3	physical 5:7	11:21, 23 12:9 14:5
materials 8:19 9:4, 12, 17, 25 10:5, 14 13:13, 21	nanotubes 6:5, 10, 13, 16, 20 7:3, 4, 6, 8 12:14, 18 13:22	Ohata 5:20, 21 12:11, 19	play 13:18	quote 13:3
matrix 9:12, 13, 17	network 8:23	Opposing 12:10, 24	point 13:9	R
means 8:1, 8, 9 9:4 10:7 11:6	non- agglomerate d 6:13	overlap 5:18	poor 10:15	range 8:1
meant 13:7	non- agglomerate d 6:13	owner 4:8	possibility 7:13	reach 8:21
medium 9:18	non- agglomerate d 6:13	P	preconditio ns 6:25	reached 9:10
mentioned 6:25 7:23 14:1	nonconducti ve 9:1, 8, 12, 17	pages 10:24	previously 6:25	read 11:3
microscopic 7:24 13:17, 19 14:1	noted 6:8	paragraph 10:22 11:1	principle 7:18 8:12	reason 14:1
mischaracte rize 9:23	notes 4:25 5:6	part 13:18	procedure 6:22 7:2, 7, 10, 16	Rebar 4:8
Molecular 4:8	number 10:23	particles 11:19	proceed 4:15	recall 12:10, 13, 23 13:2
morning 4:18, 19	o	patent 4:8, 21 5:11 10:19 11:18	proceeding 4:21 5:11	record 4:3, 5 12:3, 4, 6 14:8, 10
N	object 8:2	percentage 8:18, 19, 20, 22 9:14	provide 7:21 8:15	redirect 11:23 14:8
nanotube 6:9, 17 7:1, 12, 13, 15	Objection 6:7, 23 7:9 10:3 11:8 13:15, 23	percolation 8:13, 16, 17, 24, 25 9:7, 10, 15	provided 11:10	reference 5:19
	objects 8:5, 6, 7, 8, 9, 10	petitioner 4:10 14:6	pull 10:17	referring 8:6 13:11
	occur 13:14, 21	phenomenon 7:25	put 12:20	refers 13:8
	offered 6:4		Q	regarded 10:15
			question 8:14	relative 11:18
			questions 5:15	

remember	12:18	8:13, 16,	7:21 8:15	11:24
8:13, 14	similar	18, 20, 24,	11:6	12:1
9:21, 22	13:9	25 9:7,		13:15, 23
12:15, 16	size	10, 15	V	14:7
13:1, 5	7:25	time		
REPORTER	11:19	4:3	vacuum	
4:2, 14	13:9, 10	today	8:3	
12:2, 5	small	5:18	version	
14:9	7:25	12:10, 23	5:8	
representat	Solution	Today's	view	
ive	4:10	4:3	11:4, 7, 9,	
11:10, 12,	specificall	transcript	12, 17, 18	
16	y	5:17	volume	
representin	6:12	transmitted	8:21	
g	state	8:1	volume-	
4:9	4:4	tubes	based	
responding	status	6:21 7:16	8:20	
13:2	7:1, 11	tunneling		
role	8:3	7:19, 22,	W	
13:18	Stephen	24 12:24		
rules	4:7	13:14, 18,	wrong	
4:24	structure	20, 24	9:24	
	11:4, 10	14:2		
S	swear	turn	Y	
	4:6	10:20		
scale	sworn	twisted	yesterday	
11:15	4:13	12:21	4:20 5:16	
schematic		typically	7:17, 23	
11:4, 7, 9	T	8:3 13:17	8:11, 17	
scientific		U	9:19	
7:18 8:12	Tangled		YU	
separate	12:20	un-	4:12	
7:2	teaches	agglomerate	Z	
separated	11:15	d		
6:21	testified	7:5, 15	Zhu	
short	4:13 7:17	understand	4:12, 18	
8:4 13:4,	testimony	7:20	12:9 14:4	
7, 8, 10	6:4 14:11	understandi	Zinda	
14:2	threshold	ng	4:7, 17	
shown				