UNITED STATES INTERNATIONAL TRADE COMMISSION

WASHINGTON, D.C.

IN THE MATTER OF	)
CERTAIN TOPCON SOLAR CELLS,	)
MODULES, PANELS, COMPONENTS	) Inv. No.
THEREOF, AND PRODUCTS	) 337-TA-1422/1425
CONTAINING SAME	)

Videotaped Deposition of MARTIN PECKERAR, Ph.D.

Washington, DC

Friday, August 1, 2025

9:14 a.m.

Job No.: 593993

Pages: 1 - 249

Reported By: Dawn M. Hart, RPR/RMR/CRR

Videotaped deposition of Chris Bakewell, held at the law offices of:

PAUL HASTINGS LLP
2050 M Street, Northwest
Washington, DC 20036
(202) 551-1700

Pursuant to Notice, before Lee Utterback-Pair, Notary Public in and for the District of Columbia.

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A P P E A R A N C E S

ON BEHALF OF THE COMPLAINANTS AND THE WITNESS:

BAS DE BLANK, ESQUIRE
ORRICK, HERRINGTON & SUTCLIFFE LLP
1000 Marsh Road
Menlo Park, California 94025-1015
(650) 614-7343

ON BEHALF OF THE RESPONDENTS:

JACOB ROTHENBERG, ESQUIRE
PAUL HASTINGS LLP
2050 M Street, Northwest
Washington, DC 20036
(202) 551-1700

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A P P E A R A N C E S (Continued)

ON BEHALF OF THE ITC - UNFAIR IMPORT INVESTIGATIONS:

SARAH SLADIC, ESQUIRE
INTERNATIONAL TRADE COMMISSION
Office of Unfair Import Investigations
500 E Street, Southwest
Washington, DC 20436
(202) 205-2560

Also Present:

Adam Schuman,Videographer/Notary Public

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(Exhibits attached to transcript as indicated.)

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P R O C E E D I N G S

THE VIDEOGRAPHER: Here begins Media No. 1 in the videotaped deposition of Martin Peckerar, In the Matter of Certain TOPCon Solar Cells, Modules, Panels, Components Thereof and Products Containing Same, in the United States International Trade Commission, Case No. 337-TA-1422/1425. 09:14:02 09:14:07 09:14:09 09:14:14 09:14:16 09:14:19

Today's date is August 1st, 2025. The time on the video monitor is 9:14 a.m. The videographer today is Adam Schuman, representing Planet Depos. This video deposition is taking place at 2050 M Street, Northwest, Washington, DC 20036. 09:14:26 09:14:30 09:14:36 09:14:39 09:14:41 09:14:47

Would counsel please voice identify themselves and state whom they represent. 09:14:49 09:14:51

MR. ROTHENBERG: Jacob Rothenberg, of Paul Hastings LLP, representing Respondents. 09:14:54 09:14:56

MR. De BLANK: Bas De Blank, with Orrick Herrington & Sutcliffe LLP, representing Complainants and Dr. Peckerar. 09:14:59 09:15:01 09:15:03

MS. SLADIC: Sarah Sladic, with the 09:15:05

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Office of Unfair Import Investigations at the United States International Trade Commission. 09:15:07 09:15:10

THE VIDEOGRAPHER: The Court Reporter today is Dawn Hart, representing Planet Depos. The witness will now be sworn. 09:15:13 09:15:13 09:15:17

MARTIN PECKERAR, Ph.D. 09:15:18

being first duly sworn or affirmed to testify to the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

EXAMINATION BY COUNSEL FOR THE RESPONDENTS ADANI SOLAR USA, INC., AND MUNDRA SOLAR PV LIMITED

BY MR. ROTHENBERG:

Q Could you please state your name for the record? 09:15:34 09:15:38

A Martin Peckerar. 09:15:38

Q And can I call you Dr. Peckerar? 09:15:40

A You can call me Marty. 09:15:42

Q Okay. My name is Jacob Rothenberg. I'm an attorney with the law firm Paul Hastings LLP, and I represent Adani Solar USA and Mundra Solar PV in this investigation which are the 09:15:44 09:15:47 09:15:49 09:15:55

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Respondents. And as you know, I'll be asking you a few questions today. 09:15:57 09:16:00

Have you been deposed before? 09:16:01

A Yes. 09:16:04

Q How many times, roughly? 09:16:06

A It's my recollection of about seven times. 09:16:07 09:16:09

Q You're probably familiar with these, but I'll just quickly note some ground rules if that's okay. 09:16:11 09:16:13 09:16:16

A Sure. 09:16:16

Q As you just noted, you have been sworn under oath for these questions that we'll be discussing today; is that correct? 09:16:20 09:16:24 09:16:30

A Yes. 09:16:31

Q And if it's okay with you, could you please answer all questions verbally? 09:16:33 09:16:35

A I will. 09:16:37

Q And please wait until I finish asking a question before answering. 09:16:44 09:16:47

A Sure. 09:16:48

Q And if my question is unclear, feel free 09:16:50

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to ask me to rephrase the question or clarify it. 09:16:53

A Sure. 09:16:57

Q And if you give an answer and then realize it's an incorrect answer, you can let me know even if it occurred earlier in the day. 09:16:59 09:17:01 09:17:04

And then plan to take a break at roughly every hour, but if you need a break more frequently, just please let me know. 09:17:10 09:17:15 09:17:17

Is there any reason, medical or otherwise, you can't give truthful, accurate and complete testimony today? 09:17:19 09:17:22 09:17:25

A No. 09:17:26

Q And do you understand -- sorry, do you know if you plan to testify at trial in this investigation? 09:17:31 09:17:36 09:17:37

A If it goes to trial, I will testify, of course, if asked. 09:17:39 09:17:43

Q And is it your understanding that you'll be testifying to the opinions you gave in your report that you submitted? 09:17:49 09:17:52 09:17:55

A Yes, of course. 09:17:56

Q Did you prepare for today's deposition? 09:17:58

A Yes, I did. 09:17:59
Q Did you meet with your counsel? 09:18:03
A Yes. 09:18:05
Q Did you meet with anyone other than your counsel? 09:18:06
A I had two separate meetings, but they were very brief. One with Exponent, they did material characterization, and then we had a one-hour telecon with a Trina, I believe, who's an engineer, and Dr. Dang. 09:18:10
Q Was that in preparation for your report or in preparation for the deposition? 09:18:13
A I'm sorry, I'm not clear on the difference. I mean -- you know. 09:18:15
Q Did they occur before the report or after the report? 09:18:26
A It was during the assembly of the report, right. 09:18:28
Q After you submitted the report, have you spoken with anyone besides your counsel about your opinions? 09:18:35
A No. 09:18:37 09:18:39 09:18:44 09:18:46 09:18:48 09:18:49 09:18:51 09:18:53 09:18:59 09:19:04 09:19:07 09:19:07

Q Did you bring any documents today that you plan to refer to during the deposition? 09:19:17 09:19:19

A No, but I -- if you have a copy of my testimony, I -- 09:19:22 09:19:25

Q That's going to be my next -- 09:19:27

A Yeah, I would like that. 09:19:28

Q -- order of business. 09:19:29

A Yeah. 09:19:31

Q Last question before that, have you ever worked for Trina before? 09:19:34 09:19:36

A No. 09:19:38

Q Or consulted or had any other -- 09:19:38

A Not with Trina. 09:19:42

Q -- professional -- 09:19:43

MR. ROTHENBERG: I'd like to introduce Exhibit 1, which is your Rebuttal Expert Report of Dr. Martin Peckerar regarding U.S. Patent Nos. 9,772,104 and 10,230,009. 09:19:44 09:20:00 09:20:06 09:20:10

(Exhibit 1 was marked for identification and is attached to the transcript.) 09:20:16 09:20:16

Q Could you please take a look and confirm if Exhibit 1 is a copy of the report you submitted 09:20:46 09:20:50

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on behalf of Complainants in this investigation? 09:20:54
A Just let me take a moment to thumb 09:20:58
through. 09:21:00
(Reviewing.) 09:21:00
Apart from the yellow highlighting, I 09:21:00
believe this is my report. 09:21:52
MR. De BLANK: Sorry, just to be clear, 09:21:57
Jake, is there meant to be highlighting? 09:21:58
MR. ROTHENBERG: No. Let me -- I can 09:22:01
get you a clean copy. 09:22:06
MR. De BLANK: Page 154 I think is an 09:22:08
example of what he's referring to. 09:22:11
MS. SLADIC: My copies also have yellow 09:22:13
highlighting. 09:22:15
BY MR. ROTHENBERG: 09:23:15
Q Does Exhibit 1 contain the opinions and 09:23:47
conclusions you've reached in this investigation? 09:23:50
A Yes. 09:23:57
Q To your knowledge? 09:24:00
A To my knowledge right now. I haven't 09:24:01
had a chance to go in detail through this 09:24:06
particular copy. It does have some discrepancies 09:24:08

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between what we submitted because of the highlighting, but it looks pretty good. 09:24:11 09:24:16

Q You're not currently aware of any opinions or conclusions you've reached since submitting the report? 09:24:20 09:24:24 09:24:28

A Have I changed my mind, is that what you're asking? 09:24:32 09:24:33

Q Yeah. 09:24:34

A No. 09:24:35

Q Or did you just form new opinions in general since then? 09:24:35 09:24:37

A Some of my older opinions were amplified. 09:24:38 09:24:40

Q What amplified those opinions? 09:24:43

A The continued discussion up until the time of report preparation and -- I'm sorry, but nothing following that. 09:24:49 09:24:50 09:24:55

Q With your counsel? 09:24:56

A With counsel, yeah. 09:24:57

Q Anything to the degree that you'd want to supplement your report? 09:25:01 09:25:03

A No. 09:25:04

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Q Any new evidence that -- 09:25:08
A No. 09:25:10
Q Okay. Have you been asked to supplement your report? 09:25:10
A No. 09:25:14
Q And you don't plan to -- 09:25:15
A No. 09:25:16
Q -- to your knowledge? 09:25:17
MR. De BLANK: Dr. Peckerar, you just have to let Mr. Rothenberg finish the questions -- 09:25:18
THE WITNESS: I apologize. 09:25:20
MR. De BLANK: Yeah. Just give it a pause so if I have an objection I have a chance to put it in. 09:25:21
THE WITNESS: Okay, I'm sorry. 09:25:23
MR. De BLANK: Thank you. 09:25:24
BY MR. ROTHENBERG: 09:25:25
Q Have you reviewed the expert report of Dr. Sanjay Banerjee? 09:25:29
A Yes, I have. 09:25:31
Q And aside from your disagreements, did you find any errors? 09:25:32

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MR. De BLANK: Objection. Vague. 09:25:48

A Could you supplement your question? 09:25:52

What, you mean an absolute lack of conformance with the laws of physics or -- I mean he expressed his opinions on what are doable processing steps, and I have -- based on my experience as a process engineer, I have my opinions, so we have conflict on that, so ... 09:25:54 09:26:01 09:26:07 09:26:10 09:26:13 09:26:17

Q Right. 09:26:19

A But did he violate -- I'm sorry. 09:26:19

Q Oh, no, finish. 09:26:21

A Did he violate the laws of physics, I don't think so. 09:26:22 09:26:26

Q Oh, no, I think it's okay. 09:26:27

Did you review the expert report -- any expert report of Yocum Wrench? 09:26:31 09:26:37

A I did receive some information from Wrench -- not from Wrench, from -- and I looked through it, another 600 pages of documentation, yeah. 09:26:43 09:26:48 09:26:52 09:26:57

Q Do you remember what it was about? 09:26:58

A No. No. If you have a copy and if it 09:27:00

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becomes relevant, you can show it to me and I'll jog my memory, yeah. 09:27:04 09:27:08

Q Did you review the expert report of Douglas Ruby? 09:27:09 09:27:12

A I looked through it, yes. 09:27:14

Q Do you remember which portions or you -- 09:27:19

A No, I read the report. I can't -- yes, I read the report. But if we discuss it, I'd like to have a copy of it to go through. 09:27:21 09:27:25 09:27:32

Q Have you reviewed any of the products at issue in this investigation? 09:27:44 09:27:46

MR. De BLANK: I'm sorry, I would -- so I guess just to be -- caution the witness. I would instruct you, you can answer the question as it relates to the invalidity report and opinions you've set forth in the invalidity report to the extent you reviewed any products in forming those opinions or relied on products in making those opinions. 09:27:50 09:27:54 09:27:57 09:27:59 09:28:02 09:28:05 09:28:07 09:28:09

If you did work that was unrelated to the opinions set forth in your invalidity report, I would instruct you not to answer that. 09:28:11 09:28:15 09:28:17

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A Okay. I didn't handle physically any of the products of either Trina or Adani. I did read the -- read through the Exponent report which included spectral analyses of the material structures. 09:28:22 09:28:26 09:28:34 09:28:39 09:28:45

Q And did those -- did the Exponent report or its images change your opinions in your report? 09:28:49 09:28:52

A No. 09:28:56

Q Were you instructed to read that report? 09:29:02

A It was -- it was given to me, as you know, in a very large data package. 09:29:04 09:29:12

Q Before this -- being engaged for this investigation, were you aware of TOPCon products? 09:29:25 09:29:29

A Yes. 09:29:33

Q Were you aware of Trina's or Adani TOPCon products? 09:29:33 09:29:37

A Not specifically, but basically the base structures of course I'm well familiar with. 09:29:38 09:29:43

Q Had you done any paid work involving commercial TOPCon products? 09:29:49 09:29:57

A No. 09:29:58

Q And is Exhibit B which -- 09:30:06

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A Is that the one? 09:30:15
Q Should be at the very, very end. 09:30:21
A Yes. Exhibit A. 09:30:24
Q About five pages from the end. 09:30:47
A Yeah, that's what I'm trying to get to. 09:30:49
Exhibit B, okay. Yeah. 09:30:51
Q Are these the materials that you 09:30:59
considered in forming the opinions of your report? 09:31:01
A Yes. 09:31:04
Q And to your knowledge, are you -- did 09:31:09
you consider any materials that are not listed 09:31:15
here? 09:31:18
A I'm continuously reading papers. 09:31:20
Q You don't have a specific -- 09:31:24
A I don't have a specific -- 09:31:26
Q -- document in mind -- 09:31:26
A No. 09:31:28
Q -- that you know is not listed here? 09:31:28
A Sorry. I didn't mean to overspeak. 09:31:31
MR. ROTHENBERG: Introduce Exhibit 2 and 09:31:51
3. Exhibit 2 is TrinaSolar_ITC-00000001, and it's 09:31:52
U.S. Patent No. 9,722,104. 09:32:26

(Exhibit 2 was marked for identification and is attached to the transcript.) 09:32:32 09:32:32

MR. ROTHENBERG: And Exhibit 3 is Bates No. TrinaSolar_ITC-00000042, and that's U.S. Patent No. 10,230,009. 09:32:41 09:32:44 09:32:55

(Exhibit 3 was marked for identification and is attached to the transcript.) 09:32:56 09:32:56

BY MR. ROTHENBERG: 09:32:56

Q Dr. Peckerar, is Exhibit 2, as far as you can see, U.S. Patent No. 9,722,104? 09:33:37 09:33:40

A Yes, I generally refer to it as the '104 patent. 09:33:47 09:33:52

Q So you'll understand if I also refer to it as the '104 patent? 09:33:53 09:33:56

A Yes. 09:33:59

Q And is Exhibit 3 U.S. Patent No. 10,230,009? 09:34:00 09:34:04

A Yes, I refer to as the '009 patent. 09:34:08

Q Okay. And you'll understand if I do as well? 09:34:12 09:34:14

A Yes. 09:34:15

Q And will you understand if I refer to 09:34:18

the asserted patents I mean the '104 and the '009 patents? 09:34:20 09:34:25

A Yes. 09:34:26

Q And do you understand these patents to be related to each other? 09:34:31 09:34:32

A Yes. 09:34:34

Q And do you understand that aside from the claims, the written description of the patents are the same? 09:34:37 09:34:40 09:34:44

A With minor modifications. 09:34:47

Q Do any of those minor modifications affect your opinions? 09:34:53 09:34:56

A No. 09:34:57

Q If we could go back to your CV -- sorry, go back to your report. 09:35:06 09:35:09

A Yes. 09:35:11

Q And go to Exhibit A, after page 350. 09:35:12

A Yes. 09:35:25

Q Is this a copy of your CV? 09:35:29

A Without going through it in detail, it appears to be. 09:35:36 09:35:38

Q And do these -- does this CV at least 09:35:43

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describe the experiences that qualify you as an expert and a POSITA? 09:35:49 09:35:52

A Yes. 09:35:55

Q If you could go all the way back to paragraph 8 at the beginning. 09:36:02 09:36:06

A Paragraph 8. Is that on page 2 of the report? 09:36:23 09:36:35

Q Yes. 09:36:36

A Yes, that's the one that says, "I received a BS." 09:36:37 09:36:40

Q Yeah. 09:36:41

A Yeah. 09:36:41

Q Do paragraphs 8 through 16 summarize those experiences that qualify you as an expert and a POSITA in this investigation? 09:36:43 09:36:48 09:36:51

A Yes, with the caveat that I've given before, I haven't had time to read this specific document over, but it looks right. 09:36:56 09:36:57 09:37:00

Q So can you go paragraph 13. 09:37:10

A "From 2012 to the present," is that what you -- 09:37:15 09:37:25

Q Yes. 09:37:26

A Yes. 09:37:26
Q So from 2012 to the present, have you -- 09:37:28
your work primarily been involved with these two 09:37:32
small businesses, FlexEl Battery and VersaVolt? 09:37:36
A I certainly wouldn't say primary. I 09:37:43
think these were -- these turned into consulting 09:37:46
businesses, the last, FlexEl -- VersaVolt, rather. 09:37:54
Q And the paragraph above says: 09:38:00
From 1981 to 2002 I worked as a Branch 09:38:02
Chief at the Naval Research Laboratory. 09:38:07
A Yes. 09:38:10
Q What about from 2002 to 2012, what -- 09:38:15
A I was a Professor at the University. I 09:38:19
left the Naval Research Lab. 09:38:28
Q In 2002? 09:38:29
A Thereabouts, yeah. 09:38:31
Q And you became a Professor in the ECE 09:38:33
Department of University of Maryland? 09:38:37
A Yes. 09:38:40
Q And when did you hold that position 09:38:44
until? 09:38:45
A I'm Emeritus now, but ... 09:38:48

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Q Okay. 09:38:51
A I still supervise projects with my 09:38:53
students. 09:38:55
Q And when did you become Emeritus? 09:39:05
A I think it was 2010. That seems to be 09:39:07
my recollection. 09:39:12
Q And what did your work at the Naval 09:39:18
Research Laboratory entail? 09:39:21
A I ran the Surface Physics Branch. We 09:39:23
studied interfaces, ultra-thin films, the 09:39:26
application of these films to devices of relevance 09:39:33
to the Navy. Did a lot of work in radiation 09:39:37
matter interaction. 09:39:46
Q What was the -- what's the primary 09:39:50
applications of those thin films and interfaces? 09:39:54
A Tunneling devices. Okay? Yeah. I 09:39:59
worked on field emitter arrays for many years, I 09:40:02
worked in -- the other application is imaging 09:40:09
devices, of course, which have major similarities 09:40:12
with solar cells. The arrays and detectors are 09:40:17
basically little photon energy detectors. 09:40:22
Q Have you ever done research specifically 09:40:47

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involving solar cells? 09:40:50

A Oh, yes, that was the first part of my 09:40:53

career, yeah. 09:40:54

Q And which position was that? 09:40:59

A Through graduate school I was working at 09:41:04

NASA. And I worked in reliability, and I 09:41:06

characterized the reliability of the then-MIS 09:41:13

solar cells, and those evolved into the TOPCon 09:41:19

product. 09:41:22

Q Is that paragraph 9? If you could take 09:41:23

a look. 09:41:28

A Let me get back to that. 09:41:28

When I began my career, yeah. 09:41:33

Q The experience you were just referring 09:41:36

to? 09:41:37

A Right. 09:41:38

Q Yeah. 09:41:38

A Yeah. And I published in that area, 09:41:41

open circuit voltage of MIS Schottky diodes, yes. 09:41:45

Q And were those involving silicon solar 09:41:52

cells? 09:41:55

A Yes. We had a complementary effort 09:41:55

going on with respect to JPL. I was handling gallium arsenide solar cells, which were too expensive for commercial application. 09:41:59 09:42:02 09:42:06

Q What does "JPL" stand for? 09:42:08

A Jet Propulsion Laboratory. 09:42:11

Q Other than that experience, have you specifically done work with solar cells before? 09:42:25 09:42:28

A Could you elaborate on that a bit more? I'm sorry. 09:42:40 09:42:43

Q Aside from studying the physics underlying, you know, photovoltaics and different things, have you specifically worked on solar cell applications of these physics aside from the NASA experience? 09:42:50 09:42:53 09:43:00 09:43:04 09:43:10

A Well, there was the NASA experience. 09:43:12

Q Yes. 09:43:14

A Now, did I work in commercial solar cell fabrication? No. But I've built my own solar cells and studied the reliability of those cells, developed techniques for analyzing those cells. 09:43:16 09:43:19 09:43:25 09:43:29

Q During the NASA experience? 09:43:32

Did you study specifically the 09:43:55

application of solar cells after the NASA experience? 09:44:03 09:44:07

A I turned my attention to other devices that make use of the same principles. 09:44:09 09:44:12

Q I think you mentioned this before, but you've never worked with Trina before -- 09:44:21 09:44:22

A No. 09:44:25

Q -- or taken compensation from them? 09:44:25

A No. 09:44:28

Q Probably same question. 09:44:31

Have you ever taken compensation for work that was adverse to Adani Solar or Mundra PV to your knowledge? 09:44:32 09:44:47 09:44:53

A No. 09:44:53

Q Do you have any financial interest in either of those companies? 09:45:03 09:45:04

A No. 09:45:06

Q I didn't think so, but ... 09:45:10

What was your understanding of TOPCon solar cells before you were involved in this investigation? 09:45:11 09:45:26 09:45:28

MR. De BLANK: Objection. Vague. 09:45:29

A You want to sharpen the question or -- based on my -- 09:45:30 09:45:33

MR. De BLANK: From time to time I will make an objection. If you understand the question, you're free to answer. 09:45:36 09:45:37 09:45:39

THE WITNESS: Sure. 09:45:41

MR. De BLANK: If you don't understand the question, you're free to ask clarification, and you should do that regardless of whether I object. 09:45:42 09:45:43 09:45:46 09:45:48

THE WITNESS: Okay, I'm sorry. 09:45:48

Can you repeat the question? 09:45:50

BY MR. ROTHENBERG: 09:45:51

Q Did you have an understanding of what a TOPCon solar cell was? 09:45:51 09:45:57

A Yes. 09:46:01

Q What was your -- I guess just what is your understanding of what a TOPCon solar cell is? 09:46:05 09:46:08

MR. De BLANK: Objection. Vague. 09:46:12

A I'll try to sharpen it up. Maybe not. Okay. 09:46:14 09:46:18

I -- the TOPCon cell is an evolution of 09:46:18

the MIS solar cell that I worked on extensively, developed models for, and actually built with my own hands. 09:46:27 09:46:30 09:46:33

Q Could you elaborate on how it's an extension? 09:46:37 09:46:40

A In the one case, in the MIS case, we simply have a metal, an insulator and a semiconductor. Now, in that insulator is an ultra-thin layer through which -- actually, through a number of transport processes current is made to flow. Okay. 09:46:41 09:46:48 09:46:50 09:46:56 09:47:02 09:47:06

The difference between that and the TOPCon product is the TOPCon product puts a semiconductor over the tunnel layer, so it's basically an SIS cell, semiconductor-insulator-semiconductor cell. And that's the main difference. One is SIS, one is MIS. 09:47:07 09:47:16 09:47:22 09:47:26 09:47:29 09:47:35 09:47:41

Q When you said earlier Schottky solar cell -- 09:47:44 09:47:46

A Yes. 09:47:47

Q -- is that what you're referring to? 09:47:47

A Yeah, we call the metal semiconductor junction a Schottky junction, and the MIS process extends that by interposing the thin insulator. 09:47:48 09:47:52 09:47:56

Q And that improves it? 09:48:01

A It increases the open circuit voltage, yes, markedly. 09:48:04 09:48:08

Q Is that because it passivates the metals to the substrate surface? 09:48:09 09:48:13

A I don't want go through a rabbit hole here, but the thing of it is that there are many processes taking place, it's not a simple tunneling process. 09:48:15 09:48:20 09:48:23 09:48:27

Q MIS is not a simple tunneling? 09:48:36

A In the MIS and in the SIS. 09:48:38

Q So MIS is a thick insulator or -- 09:48:40

MR. De BLANK: Objection. Vague. 09:48:44

Q Thin -- 09:48:45

A I'm sorry. 09:48:46

Q They're both silicon substrate solar cells? 09:48:56 09:48:59

A Yes. 09:48:59

Q Okay. Do you understand that the 09:49:00

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asserted patents claim priority to two Korean patents? 09:49:23 09:49:27

A I believe so, but let me just say, what establishes priority is a legal issue, and you can probably talk to other counsel on that. 09:49:33 09:49:38 09:49:42

Q Can you go to paragraph 45 of your report. 09:49:48 09:49:50

A Yep. Okay, where "I do not affirmatively discuss applying a proposed construction," is that the one you're -- 09:49:52 09:50:09 09:50:13

Q 45. 09:50:16

A Oh, 45, "I understand the asserted patents both claim priority"? 09:50:16 09:50:19

Q Yeah. And then in 46 it says: 09:50:21

For the purposes of this report, I've been instructed by counsel to assume that the effective filing date is no later than November 28, 2014. 09:50:27 09:50:31 09:50:33 09:50:36

A Yes, which I accept, yeah. 09:50:39

Q Did you do any analysis of the Korean patent to determine if it claims priority? 09:50:42 09:50:44

A I read through the patent. I don't 09:50:50

believe I formed an opinion on priority dates. I leave that to lawyers. 09:50:56 09:51:00

MR. ROTHENBERG: Like to introduce Exhibit 4, which is Bates No. PRIORART_00023079. 09:51:13 09:51:14

(Exhibit 4 was marked for identification and is attached to the transcript.) 09:51:23 09:51:23

Q And this is both translated and an original copy of Korean Application No. 10-2014-0168624? 09:51:23 09:51:59 09:52:08

A Yes. 09:52:17

Q Have you reviewed this document? 09:52:28

A I looked it over. It went -- I've looked it over. 09:52:29 09:52:32

Q If you look at -- I'm not sure -- there's a bunch of different -- 09:52:34 09:52:41

A Yeah. 09:52:43

Q -- versions of page numbers, but starting at 4339? 09:52:43 09:52:46

A Yes. 09:52:49

Q If you're there? 09:52:50

A Yes. 09:52:51

MR. De BLANK: Sorry, just so I'm on the 09:52:53

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same -- oh, I -- the -- I see now. I see what you're referring to. 09:52:55 09:52:57

Q Would you agree that 4339 through 4343 shows the figures of this application? 09:52:59 09:53:07

MR. De BLANK: Objection. Document speaks for itself. 09:53:10 09:53:11

A I want to make sure I'm understanding you. Can you repeat the question? 09:53:19 09:53:20

Q Starting with page 39 through the next five pages, would you agree that those show the figures of the application? 09:53:22 09:53:27 09:53:30

A To the best of my recollection. Of course, to be absolutely sure, I'd have to have the documents in question side-by-side, but it looks familiar. 09:53:35 09:53:38 09:53:41 09:53:46

Q And do you see any isolation portion in these figures? 09:53:49 09:53:52

A Let's see. Of course, this is -- to my observation here, okay, this appears to be a Korean version of what became the '104 and subsequently '009 patent, and those include isolation. 09:54:05 09:54:59 09:55:04 09:55:10 09:55:17

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If you look at -- for example, if I might refer you back to '104, if you look at the illustrative figure, there's a little mouse snips at the bottom right and left of the cell, and those appear to be -- those are all isolations. 09:55:17 09:55:22 09:55:29 09:55:33 09:55:38

Q I'm not asking about the patent. I'm asking if the Korean application shows an isolation portion. 09:55:45 09:55:48 09:55:55

A No, I don't see the mouse snips in these figures. I think that's about as much as I can say. 09:56:02 09:56:09 09:56:15

Q You don't have any opinion that the Korean application discloses -- this Korean application discloses an isolation portion? 09:56:16 09:56:21 09:56:26

A I'd have to study the patent, this document, in greater detail. I remember seeing it. What I remember was that it's reproducing the figures that eventually became '104 and '009. I didn't specifically look at the -- 09:56:30 09:56:34 09:56:35 09:56:41 09:56:51

Q Just to clarify, there's two Korean -- 09:56:54

A Yeah. 09:56:57

Q -- applications, so -- 09:56:57

A Okay. 09:56:59
Q -- is it possible and this is only one 09:56:59
of them? 09:57:01
A Right. 09:57:02
Q Is it possible that you saw the 09:57:03
isolation portion in the other Korean application? 09:57:04
A That's possible, or the figure could 09:57:08
have been omitted showing the mouse snip. 09:57:12
Q Omitted in this copy? 09:57:16
A Possibly, yeah. I -- I'd have to give 09:57:19
it more study, more consideration. I'm sorry. 09:57:22
Q Oh, no. That's fine. 09:57:26
You can put that aside. I don't think 09:57:27
we'll refer to it again. 09:57:36
A Okay. 09:57:38
Q If you can go to paragraph 92 of your 09:57:39
report. 09:57:42
A "As mentioned above, Dr. Banerjee relies 09:57:53
on 11 alleged prior art references"? 09:57:56
Q Yes. 09:58:00
So this section, Section 8, says: 09:58:00
Dr. Banerjee has not established the 09:58:03

Scherff, Luque, Feldmann or Kyeong references relies on a prior art. 09:58:10 09:58:15

Is that correct, Section 8? 09:58:17

A That's the header, right. 09:58:21

Q Sorry -- 09:58:23

A That's the -- 09:58:23

Q -- 13. 13. 09:58:23

A Yeah. 09:58:27

Q My fault. 09:58:28

A 13 is the header, right. 09:58:29

Q And in 93 you say that Dr. Banerjee has not supplied any evidence showing that any of Scherff, Luque, Feldmann, or Kyeong are printed publications, quote/unquote, or other -- or are otherwise authenticated as prior art under 35 USC 102(a)(1)? 09:58:34 09:58:42 09:58:46 09:58:50 09:58:54 09:58:58

A I see that, yes. 09:59:03

Q Do you have a legal understanding of what it means to be a printed publication or otherwise authenticated as prior art under Section 201 -- 102(a)(1)? 09:59:06 09:59:08 09:59:11 09:59:16

A At best my legal understanding of these 09:59:20

terms would be inferior to yours. 09:59:23

Q Did you do an analysis to determine if they were, quote/unquote, printed publications or, quote/unquote, authenticated? 09:59:30 09:59:33 09:59:36

A All I saw were the documents that were alleged, and they were among a very large stack of documents that I was reviewing. 09:59:40 09:59:42 09:59:48

Q Do you have any other opinions on authentication other than Dr. Banerjee has not supplied evidence of it? 10:00:04 10:00:06 10:00:11

A Well, I don't think he did. I don't think he specifically described a method in which these -- the information in these documents was disseminated, but that's just my recollection for now. 10:00:15 10:00:18 10:00:26 10:00:29 10:00:31

Q Other than stating that he hasn't provided evidence, have you provided any reasons to dispute the document's authenticity? 10:00:41 10:00:45 10:00:48

A I don't know what the legal grounds are. So I have to remain silent on that. I'm sorry. 10:00:55 10:00:58

Q In your experience when a document is published in a professional or industry journal, 10:01:10 10:01:13

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does it become publicly available? 10:01:18

A It becomes publicly available, but the validity of -- or the depiction of the work therein is subject to question. And so, for example, you have a number of trade magazines and various people of perhaps questionable authority will make a statement, and these are not peer-reviewed journals. So in my mind those would have to be discounted as prior authenticated publications. 10:01:23 10:01:28 10:01:32 10:01:39 10:01:43 10:01:47 10:01:51 10:01:55 10:01:59

Q So certain journals through the peer review process in your opinion provide authentication, but more trade magazines that don't have peer review may not have? 10:02:13 10:02:15 10:02:18 10:02:21

A That would be one example, yeah. And there are -- over the years, there have been a flurry of, quote, peer-reviewed publications that have flooded the market, and those are of questionable value, so -- I mean, as I said, it's a legal question, which -- 10:02:25 10:02:28 10:02:33 10:02:39 10:02:43 10:02:47

Q By "trade publications" do you mean publications more aimed at commercial audience 10:02:57 10:03:00

instead of academic? 10:03:05

A Commercial audiences, they frequently 10:03:06

sell things through those publications. And I 10:03:11

have seen in some of these journals that propose 10:03:18

to be peer reviewed, there are sales documents, 10:03:21

right? So that's a distinction I'm making as a 10:03:26

layperson. 10:03:30

Q So is your point basically that those 10:03:34

trade magazines, there may be other incentives 10:03:36

to -- 10:03:40

A Yes. 10:03:41

Q In your paper other than just the 10:03:42

academic truth that may skew the results? 10:03:44

A Yes, you've put it well. 10:03:48

Q Could you please go back to paragraph 10:04:00

38. 10:04:02

A Sure. 10:04:03

Q Sorry, 35. 10:04:11

A Okay. "I understand that Dr. Banerjee 10:04:12

contends that the POSITA would have had at least a 10:04:17

Bachelor of Science," yeah, okay. 10:04:20

Q Do you understand the concept of POSITA? 10:04:28

A Yes. Person skilled in the art. 10:04:31
Q It's a hypothetical person with ordinary 10:04:34
skill? 10:04:36
A Ordinary skill, yeah. 10:04:37
Q Do you generally -- strike that. 10:04:39
Do you agree with this definition that 10:04:41
Dr. Banerjee has provided? 10:04:46
A I think that's the one that's generally 10:04:49
accepted from what I've seen, Bachelor's degree, 10:04:51
couple of years working in the field. A POSITA 10:04:56
would have been able to recognize what was 10:05:02
claimed. Might be able to insert the result into 10:05:08
their processes, but the person of ordinary skill 10:05:14
would not necessarily be able to come up with 10:05:19
significant innovation. That would be my -- 10:05:22
Q Just for the record, the definition 10:05:35
we're referring to says: 10:05:36
A POSITA would have at least a Bachelor 10:05:39
of Science in electrical engineering, applied 10:05:41
physics, chemistry or material science and at 10:05:45
least two years in designing, developing or 10:05:49
researching silicon solar cell technology. 10:05:51

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Additional education can substitute for professional experience and vice versa. 10:05:53 10:05:56

Did I read that correctly? 10:05:59

A Yeah. Right. 10:06:00

Q And I guess the one other requirement is that that experience be had by the time of the invention? 10:06:04 10:06:11 10:06:18

A Yes. 10:06:18

Q And you understand that to be the 2014/2015 time range -- 10:06:19 10:06:21

A Yes. 10:06:24

Q -- for these patents? 10:06:24

I think I asked you earlier, but you possessed and sort of you would say exceeded that definition, right? 10:06:29 10:06:31 10:06:38

A Oh, indubitably. 10:06:39

Q Yeah. You say that at 39 I exceeded this level of POSITA. 10:06:46 10:06:49

Did your opinions -- strike that. 10:06:51

Are your opinions from the level -- the perspective of a level of a POSITA? 10:07:05 10:07:08

A I would know what the level of a POSITA 10:07:15

was and what the POSITA as specified here would be capable of doing. 10:07:20 10:07:24

Q So you understand it's not -- it's -- the perspective of a POSITA may not necessarily be the same as your perspective, considering you may exceed the level of a POSITA? 10:07:31 10:07:33 10:07:38 10:07:43

A That would be my position. 10:07:46

Q But you took account of that distinction where necessary? 10:07:48 10:07:52

A Yes. 10:07:53

MR. ROTHENBERG: How long have we been going? 10:07:53 10:08:09

THE COURT REPORTER: Almost an hour. Seven minutes short, 53 minutes. 10:08:09 10:08:09

Q Do you want to go a little further? 10:08:16

A Go about seven minutes. I think my bladder will hold that. Not much longer. 10:08:18 10:08:20

Q And feel free to pipe up if -- 10:08:25

A Okay. 10:08:28

Q -- you ever want to take a break. 10:08:28

So just on the bottom of page 10, you have a section called Claim Construction? 10:08:30 10:08:38

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A Yep. 10:08:40
Q And page 11 shows the parties' positions 10:08:45
on the claim construction of isolation portion? 10:08:51
A Yes. 10:08:56
Q And you've applied these constructions 10:09:01
in your opinions? 10:09:07
A Well, two things. I felt that -- I'm 10:09:10
sorry, I'm going to wax poetic. 10:09:18
Yeah. The term "isolation," or 10:09:20
"isolation portion," I think would be obvious when 10:09:26
required. It can be interpreted in terms of its 10:09:32
plain and simple meaning. But I think the 10:09:37
Respondents' position is that it does require some 10:09:45
further construction, and the only thing I could 10:09:50
say here is I go back to saying, to me plain and 10:09:54
ordinary is the -- is how I would interpret this. 10:09:57
And I just want to put the caveat in 10:10:02
here that the term "isolation portion," I believe, 10:10:07
is only mentioned in the '104, '009 and related 10:10:12
patents, and it refers to the specific of -- the 10:10:19
specifics of the process to create that structure. 10:10:25
Others of those patents if we -- I don't 10:10:33

believe we can refer to them as isolation portions because they're not referred to that in the bodies of the documents. 10:10:38 10:10:41 10:10:43

Q You understand that the judge has not ruled on this issue yet, and so that these three -- three proposals have been proposed by all three parties, but there's been no decision. Is that your understanding as to which three is the meaning of the term? 10:10:53 10:10:57 10:11:04 10:11:09 10:11:12 10:11:14

A I haven't been keeping up with the judge's decisions. 10:11:15 10:11:17

Q But you -- do you have any opinions in this report on any other terms besides isolation portion -- 10:11:19 10:11:40 10:11:45

A No. 10:11:46

Q -- specifically how -- I did pause a little bit there, sorry. 10:11:46 10:11:48

Specifically how they should be interpreted as a matter of claim construction? 10:11:49 10:11:53

A As I said, I think it has a plain and ordinary meaning. 10:11:59 10:12:03

Q Other than the isolation portion, do you 10:12:05

have any opinions on how claims should be construed? 10:12:08 10:12:14

A I think that there are many claims that are vague, many claims that are made in patent literature. You know, I know the Patent Examiner is supposed to take care of all this stuff, but I believe that those would require construction, okay? 10:12:17 10:12:21 10:12:25 10:12:29 10:12:32 10:12:38

I don't recall -- I mean I know there's this issue of isolation portion, and I've given you my understanding of the fact that that's a -- that's something that exists in common parlance, and I -- 10:12:38 10:12:42 10:12:47 10:12:50 10:12:57

Q Which -- 10:12:58

A And isolation, right. 10:12:59

And I do add the caveat here that "isolation portion" was a term that was only used in one of the -- or the '104, '009 patents and that should be kept in mind in further analysis. 10:13:01 10:13:04 10:13:08 10:13:19

I hope that helps. 10:13:22

Q When you said, "I think there are many claims that are vague," which -- are you talking 10:13:38 10:13:40

about claim terms? 10:13:42

A No, I'm talking about claims in general, 10:13:44

what would require construction. Okay? 10:13:47

Q Like outside of these asserted patents? 10:13:52

A Yeah, outside of these patents. 10:13:54

Q Just -- 10:13:56

A Just -- 10:13:57

Q -- terms -- 10:13:57

MR. De BLANK: One at a time. 10:14:00

THE WITNESS: Oh, okay. I didn't 10:14:01

realize I was so bad at this. 10:14:05

Q I'm asking, of the claim terms used in 10:14:10

these patents, did you generally apply the plain 10:14:13

and ordinary meaning or their -- other than 10:14:18

isolation portion, are there terms that you 10:14:21

provided more specific meanings to? 10:14:23

A I think isolation portion was the only 10:14:29

case in which that came up. 10:14:31

Q Okay. So is -- setting isolation 10:14:33

portion aside for the other terms when you looked 10:14:42

at here's the term in the claim and whether it's 10:14:45

shown in the prior art, you applied your general 10:14:48

understanding of the plain and ordinary meaning of that term? 10:14:51 10:14:54

A Yes. 10:14:55

Q And that's what you say in 44 -- paragraph 44? 10:14:59 10:15:01

A "Where I do not affirmatively discuss applying a proposed construction, and for all other terms I've applied the plain and ordinary meaning as it would have been understood by a POSITA at the time of the invention." Yes. I would stand by that portion of my report. 10:15:04 10:15:15 10:15:18 10:15:22 10:15:25 10:15:30

Q What do you mean "where I do not affirmatively discuss applying a proposed construction"? 10:15:35 10:15:37 10:15:41

A Well, the only case that that might be relevant was the one regarding the isolation portion. I mean if I did mention it other -- I mean it's a long report, that combined with Banerjee combined with the patents themselves, it was a lot of reading. 10:15:42 10:15:43 10:15:48 10:15:53 10:15:56 10:15:59

MR. ROTHENBERG: You want to take a quick break? 10:16:10 10:16:11

THE WITNESS: Sure. 10:16:12

MR. ROTHENBERG: Or however long you want. 10:16:12

THE VIDEOGRAPHER: We are going off the record. The time is 10:16 a.m. 10:16:15

(A recess was taken.) 10:16:17

THE VIDEOGRAPHER: We are back on the record. The time is 10:34 a.m. 10:34:23

We are going off the record. The time is 10:34 a.m. 10:34:26

(A recess was taken.) 10:34:43

THE VIDEOGRAPHER: Stand by one moment. We are back on the record. The time is 10:37 a.m. 10:37:08

MR. ROTHENBERG: For the record, we are reintroducing Exhibit 1 as a new document. As the witness noted, the originally stamped Exhibit 1 contained highlighting that was not present in the as-filed report, and the restamped version is intended to correct that and is being reintroduced as Exhibit 1 but is otherwise intended to be the same document as the originally stamped Exhibit 1. 10:37:21

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(Exhibit 1 was remarked for identification and is attached to the transcript.) 10:38:07

BY MR. ROTHENBERG: 10:38:07

Q Do you want take a moment to check if it's your report? 10:38:34

A (Reviewing.) 10:38:42

Well, I can see that the highlighting, which I noted earlier is gone, and to the best of my knowledge, it appears as though it's the same document other than that modification. 10:38:56

Q Can you please go to paragraph 2. 10:39:11

A Paragraph 2 in particular? 10:39:23

Q Yeah. 10:39:25

A Okay. 10:39:26

Q Here it says: 10:39:30

I'll be asked to consider the validity of claims 1 through 10 of the '104 patent and claims 1 through 13 and 16 through 17 of the '009 patent. 10:39:31

A Yes. 10:39:43

Q In my opinion, all these claims are valid. 10:39:43

Did I read that correctly. 10:39:47

A I see that, yes. 10:39:50

And also I note that Trina's move to terminate claim 11 of the '104 patent and claim 14 of the '009 patent. Yeah, it all looks about right. 10:39:51 10:39:56 10:40:00 10:40:04

Q So would you agree that your opinions in this report are whether the asserted claims are valid or not? 10:40:08 10:40:11 10:40:19

A The essence, yes. This is a validity exercise, right. We're trying to assess validity. 10:40:25 10:40:28

Q And you haven't been asked to provide expert opinion regarding the issue of claim construction? 10:40:33 10:40:37 10:40:40

A I was pointed to it, but no, I haven't been asked to comment on it. 10:40:42 10:40:44

MR. ROTHENBERG: Just for the record, to the extent Dr. Peckerar's earlier opinion that in his opinion the term "isolation portion" should be given its plain and ordinary meaning in his discussion about the common parlance, Respondents reserve to strike that testimony as outside the 10:40:46 10:41:00 10:41:07 10:41:10 10:41:14 10:41:15

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scope of his report. 10:41:21
MR. De BLANK: I understand your 10:41:24
position. 10:41:25
THE WITNESS: It's okay with me. 10:41:25
MR. ROTHENBERG: That's just -- nothing 10:41:30
directed at you, just legal. 10:41:31
THE WITNESS: I won't sulk over it. 10:41:34
BY MR. ROTHENBERG: 10:41:36
Q But what you have done is -- in this 10:41:44
report is apply those constructions to your 10:41:46
opinions about validity in the prior art that -- 10:41:48
A What I perceive is the common parlance, 10:41:55
that's how I interpreted it, yeah. 10:41:58
Q You're referring to -- you're saying -- 10:42:07
strike that. 10:42:12
You're referring to Trina's 10:42:15
construction? If you look at page 11, Trina's 10:42:17
construction says: 10:42:29
The term should be given its plain and 10:42:32
ordinary meaning and is thus not a means plus 10:42:32
function limitation. 10:42:32
A Yes. That would be my -- 10:42:37

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Q And so --
A I concur with that, yes.
Q So for the plain and ordinary meaning construction -- strike that.
What is your understanding of the plain and ordinary meaning of isolation portion?
A Well, an isolation in general -- and let me take this in two parts.
An isolation portion prevents, in this case -- in general, it would be any type of physical contact between two regions. And in this case, this would be electrical contact.
And addition of the term "portion" refers to the methods which are being used to fabricate those in my mind in the '104 and the '009 patents.
So isolation by itself is well-known. Isolation portion as it's -- I don't know if you consider that an expansion, but that's the parlance it's used in the '104 and the '009 patents.
Q So when you say "isolation in

general" -- strike that. 10:44:22

When you said, "Isolation prevents in this case -- in general, it would be any type of physical contact between two regions, and in this case, this would be electrical contact" -- 10:44:29 10:44:34 10:44:36 10:44:40

A Right. 10:44:43

Q -- are you saying isolation is of both physical and electrical contact? 10:44:47 10:44:51

MR. De BLANK: Objection. You have to wait for him to finish the question, and you have to give me a chance to object, just give it a beat. Sorry. 10:44:53 10:44:55 10:44:57 10:45:00

Objection, vague, misstates the testimony. 10:45:01 10:45:03

A Could you repeat? 10:45:05

Q Could you clarify -- when you say, "The isolation prevents any kind of physical contact between the regions, and in this case this would be electrical contact," could you clarify what you mean by that? 10:45:09 10:45:14 10:45:19 10:45:24 10:45:27

A Yeah, I mean the idea would be in the general electrical engineering sense, as it 10:45:28 10:45:36

pertains to silicon technology, you would create some barrier to the outcome of physical contact between two -- any -- well, any regions, okay? 10:45:40 10:45:46 10:45:53

You form a kind of -- I'm sorry to be so vague here, but the idea is that you isolate one region so that it can't either receive -- in this case, can't either receive or transmit electric current, okay? So that would be the general issue of isolation. 10:45:56 10:46:02 10:46:09 10:46:12 10:46:16 10:46:20

And the way you create that isolation, the physical structure as it's explained in the two patents I referenced, hence the term "portion." So it's kind of -- kind of limits the scope, if you will. It limits it to the techniques that are described in '104 and '009. 10:46:21 10:46:25 10:46:29 10:46:35 10:46:41 10:46:46

Q So are you saying that the term "isolation" prevents physical contact and in this context -- in this context because you're isolating two conductor regions, that it also prevents electrical current from flowing because the physical contact allow -- is what allows the electrical current to flow? 10:46:57 10:47:02 10:47:08 10:47:11 10:47:20 10:47:23 10:47:28

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MR. De BLANK: Objection. Vague, misstates the testimony. 10:47:28 10:47:31

A I think what you're saying is correct. Okay. I mean, for example, a bumper prevent -- isolates your car from mechanical contact with the world around it. So that's a form of mechanical isolation. 10:47:32 10:47:34 10:47:40 10:47:45 10:47:48

Electrical isolation pertains to the impediment that's provided to electrical currents. 10:47:48 10:47:52

Q So isolation prevents physical contact that would produce current? 10:48:10 10:48:16

A Right. 10:48:19

Q And the isolations effect by preventing the physical contact is to prevent the current? 10:48:19 10:48:24

A Correct. 10:48:27

MR. De BLANK: Objection. Vague. 10:48:27

A And in thinking about this, sometimes we refer to isolations as preventing electromagnetic interactions like electric fields from propagating into a region. But in this case we're mainly concerned with electric current. 10:48:33 10:48:37 10:48:46 10:48:50 10:48:53

Q And you said -- well, the term "portion" 10:48:58

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specifies it to these asserted patents? 10:49:09
MR. De BLANK: I wasn't sure if you 10:49:16
finished your question, I'm sorry. 10:49:17
Objection, vague. 10:49:19
Go ahead. 10:49:20
THE WITNESS: I didn't say anything. 10:49:22
MR. De BLANK: No, you're good. 10:49:24
THE WITNESS: Okay. 10:49:26
A Yeah, there are a number of types of 10:49:26
contact. We talk about physical contact, 10:49:32
mechanical contact, electrical contact, field ion 10:49:35
penetration, okay? Maybe -- I forget, was there 10:49:41
anything else? The portion. 10:49:48
Q Yeah, the term "portion," what's your 10:49:49
interpretation of that term? 10:49:51
A Yeah, it prevents a physical current 10:49:52
from flowing between two regions, yeah. 10:49:55
Q So the portion is providing the 10:50:00
isolation, so it's an isolation portion? 10:50:06
MR. De BLANK: Objection. Vague, 10:50:09
misstates the testimony. Calls for a legal 10:50:09
conclusion. 10:50:11

A It's about right. 10:50:17

Q Did you use any technical dictionaries or encyclopedias to aid in your understanding of the term? 10:50:39 10:50:46 10:50:51

A I think -- I know I referenced the -- I think it's Webster in this, but -- and I generally go to the OED, okay, so for isolation -- 10:50:53 10:50:57 10:51:01

Q What is OE -- 10:51:06

A Oxford English Dictionary. 10:51:07

Q You consulted that for this case? 10:51:10

A I have it on my desk, yeah. Well, I have it in the file cabinets. It's big. 10:51:12 10:51:16

Q So when you apply the plain and ordinary meaning of "isolation portion," are you considering that limited to any particular types of structures? 10:51:41 10:51:43 10:51:46 10:51:50

A Well, as I said, since we added "portion," I limited it to the structures that are disclosed in '104 and '009. 10:51:53 10:51:56 10:51:59

Q And if we refer to Exhibit 2, could you show which structures you're talking about? 10:52:12 10:52:20

A Okay. Yeah, if you go to sheet 2, 2 of 10:52:22

18, you see the mouse snips at the lower left and lower right of the drawing, and there's actually a blowup of that in which we see that there are conductive materials, 170, which would be the backside field region, and other layers and other parts that might be anti-reflection coatings or passivation layers. Okay. 10:52:34 10:52:44 10:52:48 10:52:53 10:52:57 10:53:00 10:53:05

But there's a very thin layer, 190, which is -- which is an insulator and prevents contact between -- well, is there a way that I can demonstrate it? 10:53:06 10:53:15 10:53:22 10:53:26

MR. De BLANK: No, just answer his question. 10:53:29 10:53:31

THE WITNESS: Use my words, okay. 10:53:31

A All right. You can see threefold layer structure on the top left of the circle drawing, okay, and you see the backside field region, 170, which is a conductor, you see the tunnel location, 160, you see the passivating layer on top, okay? 10:53:33 10:53:41 10:53:45 10:53:54 10:53:58

What remains in the region labeled "I" for isolation, okay, as an insulator which would prevent contact between the upper layer structure 10:54:04 10:54:10 10:54:16

and the lower layer structure. 10:54:20

Q When you said "mouse snips," are you 10:54:28

referring to I? 10:54:31

A I'm referring to the whole structure to 10:54:32

the left and to the right of I. If you look at 10:54:37

it -- I don't know how to do this better, I 10:54:40

apologize, but if you look at the drawing, on the 10:54:43

lower left and the lower right, it looks as though 10:54:47

a mouse had taken a nip out of it. 10:54:50

Q So you're referring to the fact that at 10:55:14

the bottom edge of the substrate on the edges the 10:55:20

bottom layers become inset from the edge by some 10:55:27

amount. You're not referring to the zigzags 10:55:33

across the bottom surface? 10:55:41

A Those zigzags used to be clear. 10:55:45

Those -- just to be clear, those are -- that's the 10:55:48

result of a surface roughening process that 10:55:52

renders the appearance of those surfaces black, 10:55:55

okay? 10:55:59

Q That's not what you're referring to as 10:56:00

the mouse snips? 10:56:02

A Not the zigzag structure. I'm saying 10:56:04

that the mouse snips extended to the left and to the right of the region I as drawn -- specified in the circular emphasized drawing below the main diagram. 10:56:07 10:56:10 10:56:13 10:56:18

Q I'm just still confused what you mean "the region to the left and the right." 10:56:25 10:56:27

A Okay. If you -- okay, the lower film -- the lowest film that you see, the one closest to the bottom of the page, extends -- it's a passivating layer, and it's an insulator, and it extends over 170, which is the backside field region. 10:56:29 10:56:35 10:56:39 10:56:42 10:56:47 10:56:53

And it extends upward past through the I region, into the upper layer structure, which includes an anti-reflection -- the continuation of the passivation later and anti-reflection coating and another anti-reflection layer. I don't remember all the numbers. 10:56:53 10:56:59 10:57:03 10:57:08 10:57:12 10:57:15

Okay. That whole region within the circle represents the isolation which is -- which I'm viewing as an extension of the drawing here, which shows I as the insulating portion -- 10:57:16 10:57:22 10:57:29 10:57:33

isolating portion. 10:57:38

But I believe that -- it's my opinion, 10:57:40

okay, that the isolation portion is represented by 10:57:45

the -- pretty much the whole of the region in the 10:57:50

circle because those -- each of those layers is 10:57:53

necessary to realize the final structure. 10:57:57

Q And by "mouse snips," you're referring 10:58:00

to the fact that material has been removed from 10:58:24

bottom edges? 10:58:28

A Yeah, clearly material has been removed, 10:58:32

yes. 10:58:34

Q Could you form an isolation portion 10:58:53

without the removal of material? 10:58:56

MR. De BLANK: Objection. Vague. 10:58:59

Incomplete hypothetical. 10:59:00

A I could hypothesize on a number of ways 10:59:04

to achieve isolation without material removal. I 10:59:07

mean in my role -- I'll have to do this. I'm 10:59:15

getting beaten up for this. Okay. 10:59:18

But I mean isolation is what enabled 10:59:21

microelectronic technology, in particular diode 10:59:26

isolation, which is achieved even by diffusion or 10:59:31

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implantation and there's no removal of material. 10:59:34
So it is possible. But this -- 10:59:38
Q That's under the broad umbrella of 10:59:45
isolation in the -- 10:59:48
A In the broad sense, yeah. 10:59:49
Q In the field of semiconductors? 10:59:51
A Yeah. But we're trying to focus on the 10:59:54
isolation that's employed in the subject patents. 10:59:58
Q And so for example, is that because 11:00:08
transistors are generally isolated from each other 11:00:10
so that they hold their separate charges -- 11:00:14
A Right. 11:00:17
Q -- and whatnot? 11:00:17
A They act independently. 11:00:18
Q So is that historical development of 11:00:26
isolating semiconductor regions using insulators, 11:00:35
that historical development is relevant to this 11:00:40
patent? 11:00:47
MR. De BLANK: Objection. Vague. 11:00:48
A I think -- 11:00:52
MR. De BLANK: Compound. 11:00:53
MR. ROTHENBERG: I'll withdraw the 11:00:53

question. 11:00:59

A Okay. 11:01:00

Q In your opinion, is the term -- is the plain and ordinary meaning of isolation portion related to the term "edge isolation"? 11:01:17 11:01:19 11:01:23

MR. De BLANK: Objection. Vague. 11:01:27

A Well, if you form the isolation at an edge, I think it would be fair to say that you can call it an edge isolation, but it would have to fall on the edge. It wouldn't be displaced, but it would fall on the edge, yes, as this does. 11:01:32 11:01:35 11:01:38 11:01:41 11:01:47

Q So you'd consider the isolation portion I an example of an edge isolation technique? 11:01:50 11:01:55

MR. De BLANK: Objection. Vague. 11:02:00

A I'd have to look at all the context here. But the mouse snips are at the wafer edges. 11:02:02 11:02:06

Q Do you have any familiarity with different techniques that were known in the art before 2015 to provide edge isolation? 11:02:22 11:02:25 11:02:27

A There -- yes, the process technology toolbox is very large, okay? As I'm fond of saying, you can build the Empire State Building on 11:02:38 11:02:45 11:02:49

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a chip, okay? Who would be motivated to do that, I don't know, okay, but there are a number of different processes, material handling and steps that could be employed, so -- it's a huge plethora. 11:02:54 11:02:58 11:03:02 11:03:08 11:03:15

Q Would you agree that -- are you familiar with a metric called shunt resistance? 11:03:37 11:03:44

A Sure. 11:03:47

Q In your opinion, is the metric of a shunt resistance a measure of how well two conductor regions are isolated? 11:03:51 11:03:52 11:04:00

A That would depend on how you measure the shunt resistance, what terminals you're using, where you're placing your probes. 11:04:11 11:04:13 11:04:17

Q You're looking at Figure 2 right now? 11:04:23

A Figure 2, yes. 11:04:31

Q And would you agree that in Figure 2 the two conductive layers are marked 170 and 120? 11:04:36 11:04:46

A Let's make sure. Okay -- yeah, 120 -- yes, 120 is the emitter, and -- which in this case is a p-type emitter, and then 170 is the backside field region, which is an n -- an n-type layer. 11:04:55 11:04:59 11:05:10 11:05:17

Q And so the n-type layer, 170, could be a phosphorus polysilicon layer? 11:05:27 11:05:33

A It could be. 11:05:38

Q And the 120 layer could be a boron doped diffusion of the silicon substrate? 11:05:39 11:05:43

A It could be. 11:05:47

Q So if you were to probe layer 120 and 170, would you expect that adding the isolation portion would cause the shunt resistance to go up, if all else is equal? 11:05:57 11:06:12 11:06:21 11:06:26

MR. De BLANK: Objection. Incomplete hypothetical. 11:06:28 11:06:29

A You have to explain that a little bit more to me. 11:06:30 11:06:32

Q So the isolation portion I, you said earlier it's providing isolation? 11:06:33 11:06:38

A That's one of the components, yes. 11:06:42

Q So would the effect of that isolation be to increase the shunt resistance of the solar cell? 11:06:46 11:06:51 11:06:55

A I'm just looking at the structure here. I just want to make sure I'm physically correct 11:07:07 11:07:23

here. 11:07:26

I mean the -- you can stick a probe between -- on 170, and if you were to stick a probe on 120, okay, then if you measure the current and -- here's the problem, okay? 11:07:26 11:07:33 11:07:38 11:07:51

If you were to do that -- remember, 120, even though it's separated from the semiconductor by the tunnel layer, and 170, which is separated from the semiconductor by the tunnel layer 160, it is a diode, okay? 11:07:58 11:08:04 11:08:09 11:08:15 11:08:23

And so the method that you're hypothesizing here to -- I take -- this is my interpretation of what you're saying. Please correct me if I'm wrong, okay? 11:08:25 11:08:31 11:08:37 11:08:38

I mean what you're saying is that -- is the resulting resistance defined by that deviser I just postulated. It is that, a shunt resistance, which would quantify the ability of the insulating layer I from holding off current between the top layer structure and the bottom layer structure, well, no, because you'd be forming a contact to a diode, okay, and that diode, it will have a 11:08:41 11:08:44 11:08:49 11:08:53 11:09:00 11:09:03 11:09:06 11:09:11

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forward and a reverse current. 11:09:18

You could define a diode -- an effective 11:09:20

diode resistance, which was the slope of the diode 11:09:25

IV plot, okay, but would it give you a meaningful 11:09:28

measure of the ability of that region to isolate, 11:09:35

no. 11:09:38

Q The purpose of my question was to try 11:09:51

and figure out, is there a way one can determine 11:09:53

how well a given solar cell is isolated? 11:10:01

MR. De BLANK: Objection. Outside the 11:10:07

scope of the report. Incomplete hypothetical. 11:10:08

Vague. 11:10:10

A Well, you pose an interesting question, 11:10:14

how would you quantify the efficacy of this mouse 11:10:17

snip in creating an isolation between the top 11:10:23

layers and the bottom layers. 11:10:28

These are measurement techniques that 11:10:29

one has to consider carefully, and one would have 11:10:33

to consider carefully the possibility of other 11:10:37

current paths. And, you know, I'd rather not 11:10:39

render an opinion on that now for that reason. 11:10:43

I'd have to really sit down and think, and I do 11:10:46

this all the time, you know, but I'd have to think more carefully, and I don't feel an off-the-cuff answer would be meaningful here. I mean -- I suppose, but that's where I get "I suppose", and I don't think it pays to go further. 11:10:49 11:10:52 11:10:57 11:11:09 11:11:12

Q Are you familiar with the term "shunt resistance"? 11:11:25 11:11:27

A Sure. Yeah. 11:11:28

Q Does it relate to the term you just mentioned, "leakage current"? 11:11:31 11:11:32

A I would say they're different, okay? Because leakage currents could refer to generation recombination currents. Leakage currents could be due to the addition of a parasitic resistance between two nodes. 11:11:37 11:11:41 11:11:44 11:11:49 11:11:53

Q Would you agree that a solar cell which has a short circuit between its constructive regions is not isolated? 11:12:14 11:12:19 11:12:23

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Calls for speculation. 11:12:26 11:12:28

A Well, the goal of all of these structures, okay, ideally you have a branch which 11:12:33 11:12:37

consists of a diode, which follows from -- which on the top of the diode is connected to, say, the top terminal here. 11:12:45 11:12:52 11:13:02

And then -- and then the -- okay, so you've got a top contact, a diode, and then that top contact, rather than flowing through a parasitic diode that might be present in the bulk, would flow through a load and then back into the device, okay? 11:13:03 11:13:14 11:13:22 11:13:27 11:13:33 11:13:37

So -- but in this case, what's happening is that there's a shunt diode that exists between a top layer conducting region, a possibly contaminated sidewall of the resistor, and goes into the backside field, and so the current -- the generate -- photo-generated current, or any current that you generate either by bias or photo generation, that current is robbed from the load. So you can't deliver the power to the load. Okay? 11:13:38 11:13:46 11:13:55 11:13:59 11:14:05 11:14:14 11:14:17 11:14:20 11:14:26

So that's what we're trying to avoid here, okay? That you have an unintentionally doped sidewall, okay, and that unintentionally doped sidewall will short with the underlying 11:14:32 11:14:38 11:14:44 11:14:50

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backside field layer, and the current will form a loop within the device itself. No current will get out, no current will empower load. 11:14:54 11:14:58 11:15:01

Q You said that's what you're trying to avoid? 11:15:07 11:15:09

A That's what we're trying to avoid, right. And so you can see that this mouse snip is aimed at breaking that conducting path between the contaminated sidewall, the upper emitter, and the lower backside field region. That's what -- 11:15:10 11:15:12 11:15:15 11:15:20 11:15:23

Q So if you were -- and I know you said, you know, we need to give it some thought, but just at a high level nailing down what you would give thought to, if you were to determine whether this isolation portion is -- I is effective, you would figure out a way to determine -- quantify that current, essentially, and if it was a high current, it would mean it's doing its job, not doing its job, and if there's a low current, it would mean it's doing its job better? 11:15:32 11:15:34 11:15:39 11:15:42 11:15:48 11:15:52 11:15:56 11:16:01 11:16:05 11:16:08

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Outside the scope of the 11:16:11 11:16:11

report. Calls for speculation. 11:16:14

A With that, what I'm saying is that there are many parasitic shunts. You have -- like I said, you got a main diode of the solar cell itself. I mean, you've got many parasitic shunts that you have to consider. 11:16:18 11:16:24 11:16:28 11:16:32 11:16:38

And so I mean if you probed right across the layer from two conducting regions and you saw a dead short, well, that -- I probably wouldn't be viewed as a great isolator. But how are you going to do that? These are very thin films. You'd have to cross-section the device. Yeah, again, it would require some thought. 11:16:38 11:16:44 11:16:48 11:16:53 11:16:59 11:17:02 11:17:07

Q Okay. Can you go to paragraph 61 of your report. 11:17:10 11:17:18

A Of my report, okay. Oh, here it is. "Inventors developed and claimed a solution"? 11:17:19 11:17:32

Q Yeah. 11:17:34

A Okay. 11:17:34

Q Could you reread paragraphs 60 and 61 to refresh yourself on this opinion. 11:17:35 11:17:40

A In the method -- 11:17:44

MR. De BLANK: You're welcome to read it out loud, but I think it's easier for the Court Reporter if you just read to yourself and let Mr. Rothenberg know when you're finished. 11:17:46 11:17:47 11:17:50 11:17:52

THE WITNESS: Okay. 11:17:54

(Reviewing.) 11:17:54

A I've read 1 -- I'm sorry, I've read, yeah, paragraph 160, paragraph 161, and is there anything else you want me to -- 11:19:57 11:20:02 11:20:05

Q I just have a couple of questions about -- 11:20:08 11:20:10

A Okay. 11:20:10

Q -- what you've -- 11:20:11

A Read. 11:20:12

Q -- described here. 11:20:13

So in the block quote of the patent here, it's -- 11:20:13 11:20:34

A "That is when" -- yeah, it starts with "That is when." 11:20:36 11:20:43

Q Oh, yes, yes, yes, "That is when." 11:20:45

This is describing that the p doped layer 120 may be unwantedly diffused into the side 11:20:46 11:20:55

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or the edge of the back of the substrate. Is that your interpretation? 11:20:59 11:21:06

A Sure, yeah. The sidewall can become contaminated, as I mentioned earlier. Contaminated in this case with the p doping from the emitter. 11:21:09 11:21:11 11:21:14 11:21:17

Q And so in 61 when you say, "The inventors developed and claimed a solution to prevent this," are you referring to a solution to that problem of the diffusion? 11:21:19 11:21:23 11:21:26 11:21:29

A Yes. 11:21:32

Q And you say -- sorry, were you -- 11:21:37

A No, waiting on you. 11:21:40

Q So when you say, "To prevent this unwanted short circuit, an isolation portion that prevents a contact," are you equating "prevents a contact" with "prevents a short circuit"? 11:21:41 11:21:43 11:21:47 11:21:56

A Yes. 11:22:00

Q Between -- and by "opposite conductive type regions," you mean the 120 p-type region and the 170 n-doped region? 11:22:04 11:22:07 11:22:11

A Yes. 11:22:15

Q And when I say "p-type region," I may accidentally say boron doped region, but if I'm saying that, I'm not saying the patent is limited to that, but in my mind they're synonymous. 11:22:24 11:22:28 11:22:33 11:22:35

And the same with 70 -- 170 -- I will sometimes say "phosphorus-doped region." If you're not sure what I'm referring to, you can always ask to clarify. 11:22:38 11:22:41 11:22:45 11:22:48

A Sure. 11:22:49

Q So the second sentence of paragraph 60 starts with, "As a result of this manufacturing process"? 11:22:51 11:23:05 11:23:08

A Yes. 11:23:10

Q You see that? 11:23:11

A Yes. 11:23:12

Q In your opinion, what about a manufacturing process would cause unwanted diffusion of a dopant? 11:23:16 11:23:19 11:23:24

A I'm trying -- 11:23:36

MR. De BLANK: Objection. Incomplete hypothetical, vague. 11:23:37 11:23:38

A And I'm trying to make a succinct 11:23:40

response to this. 11:23:43

Okay, there are a number of ways to dope a semiconductor. The one that's referred here is one in which a gaseous diffusion is used in a diffusion furnace. The dopant atoms, or the molecules that will release the dopant atom, will float over any exposed surface, any surface that the gas can get to. That if you laid the wafer down on a -- I'm doing a little more than hypothesize. This is the way you make the stuff. 11:23:46 11:23:49 11:23:54 11:23:59 11:24:03 11:24:10 11:24:13 11:24:17 11:24:24

Okay, you lay the wafer down. The backside is -- we no longer can see the gaseous open, but the edges can, and those edges will reach down to the backside field, 170, and create a short. Okay? 11:24:26 11:24:30 11:24:32 11:24:37 11:24:43

Now, look at it this way, it is another diode that is being formed here, and that diode is -- creates a current loop from top to bottom, top to bottom, okay? Doesn't get out of the current from that loop, doesn't get out of the device, okay? 11:24:52 11:24:55 11:24:58 11:25:02 11:25:05 11:25:07

But if you remove that -- that 11:25:08

parasitic, okay, then current is going to flow from the emitter region down through the load back into the backside field. Okay? 11:25:13 11:25:17 11:25:22

So the parasitic resistance or current path has been eliminated or is not present there. So what you want to do is kill that first parasitic, and that means you've got to separate the two poles of the resulting diode, the atom from the cathode, okay, and then you won't get this parasitic loop which robs current from load. That's what this means. 11:25:25 11:25:29 11:25:32 11:25:36 11:25:38 11:25:43 11:25:47 11:25:52

Q So in the gaseous exposure of the dopant, the -- presumably it's a condition such that those dopants will diffuse into the substrate? 11:26:14 11:26:22 11:26:31 11:26:34

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 11:26:36 11:26:38

A I think what you're saying is what -- 11:26:40

Q I can rephrase it if it's confusing. 11:26:42

A No -- he may object again. 11:26:45

Q I was just clarifying. When you said the wafer is exposed to the gases, the purpose of 11:26:50 11:26:52

that is that the gas -- those dopants in the gas are diffused into the wafer? 11:26:57 11:27:00

A Yes. 11:27:03

Q Okay. 11:27:04

A And you want them to form the emitter, okay? Unfortunately, it's a gas, and it goes all over the place, so it will coat the sidewall. 11:27:04 11:27:08 11:27:13

Now, there are other techniques that you can use that I think we have to discuss later, okay, that you can prevent this effect with. Okay? 11:27:16 11:27:17 11:27:21 11:27:25

Just to mention a few; one, ion implantation. Ion implantation is highly directional. The ions go down, they don't hit the sidewall, okay? And so you don't have to have that parasitic, okay? 11:27:25 11:27:28 11:27:33 11:27:37 11:27:41

Q Ion implantation is a technique to form dopants exactly where you want? 11:27:46 11:27:51

A Yes. 11:27:53

Q Okay. But as of the relevant time frame, 2014/15, why was -- strike that. 11:27:54 11:28:03

As of the relevant time frame, was using 11:28:11

gaseous exposure a common technique to dope the silicon substrate? 11:28:16 11:28:20

MR. De BLANK: Objection, vague, incomplete hypothetical, outside the scope of the report. 11:28:22 11:28:23 11:28:26

A Okay. It was a well-known technique. Gaseous diffusion was one of the first doping techniques employed I think around 1955, William Shockley bought a mandograph accelerator, put it online, ran trial semiconductive, and then we got ion implantation. So these have been around for a while. There are issues -- well, excuse me. 11:28:27 11:28:31 11:28:37 11:28:40 11:28:44 11:28:49 11:28:53 11:28:55

Q So why wouldn't -- instead of providing this isolation portion, why wouldn't a POSITA just remove the boron from the sidewall? 11:29:08 11:29:16 11:29:23

MR. De BLANK: Objection. Vague. Outside the scope of the report. Incomplete hypothetical, calls for speculation. 11:29:26 11:29:28 11:29:30

THE WITNESS: I agree. Sorry. 11:29:31

MR. De BLANK: Just respond to his questions, you don't need to address me. 11:29:36 11:29:37

THE WITNESS: It was a joke. 11:29:40

MR. De BLANK: I understand, I 11:29:42

understand. 11:29:42

THE WITNESS: I apologize. 11:29:43

A Okay. All right. I mean there are 11:29:44

differences in expense for the given process what 11:29:50

tools are available, but we will see it -- I 11:29:54

mean -- but how can you -- how can you just -- 11:30:00

this is an issue which is going to come up again 11:30:04

and again. How do you do that. How do you remove 11:30:07

just the sidewall, okay? 11:30:09

Contamination. I mean, there are a few 11:30:13

ways to do that, and I think there was one 11:30:17

document that I read that they talked about 11:30:23

creating what's called an edge capital. They 11:30:28

would grind around the periphery of the wafer, but 11:30:32

you scratch your head and said well, you might 11:30:36

break the wafer, but okay, on top of that, even if 11:30:39

you don't, then you're left with a heavily damaged 11:30:43

sidewall which would serve the purpose of the 11:30:46

short which would create the short. 11:30:49

So all I'm saying is there are a whole 11:30:51

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bunch of things that can do. The process toolbox is huge, okay? Which one would you use, it depends on the goal that you're trying to achieve. 11:30:53 11:30:57 11:31:00

Here, once you've contaminated the sidewall, it would be very difficult to remove the contamination. 11:31:04 11:31:07 11:31:20

Q So is it fair to say that at least as of this date, that if you did have unwanted contamination, there was no clearly superior method to remove it that the whole industry recognized was superior than any other technique, every existing method had shortcomings? 11:31:28 11:31:33 11:31:38 11:31:44 11:31:46 11:31:51

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Calls for speculation. Outside the scope of the report. 11:31:55 11:31:56 11:31:59

A Right, but I can speculate. I mean ion implantation has been proposed in other of the patents that we're discussing here, okay? You pick a process sequence, as I said, expense, time, the availability of a tool. And so the final decision depends on considerable analysis. If we have two days, we could talk about all that. 11:32:02 11:32:10 11:32:16 11:32:20 11:32:28 11:32:40 11:32:43

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Q For removing unwanted diffused material, other than sawing the edge, sitting here right now, do you -- can you think of any other techniques that were known at this time to remove unwanted diffusion? 11:33:04 11:33:11 11:33:18 11:33:21 11:33:24

MR. De BLANK: Objection. Incomplete hypothetical. Calls for speculation. Outside the scope of the report. 11:33:26 11:33:27 11:33:29

A I think those two techniques were available at the time, and when we go on to discuss, for example, Chang, we'll see that people did pursue other techniques. 11:33:35 11:33:38 11:33:46 11:33:51

But let me just point out again, I mean, each -- just because it looks good on paper and you say well, I've got all the tools, until you look at the net result, you don't know. So I can hypothesize all I want. 11:33:54 11:33:58 11:34:02 11:34:06 11:34:10

Q Just to clarify, when you said "two techniques," are you referring to the sawing and the ion implantation? 11:34:12 11:34:14 11:34:17

A I don't think anybody really grind. I did see it used, but the two techniques that we're 11:34:20 11:34:22

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talking about right now are gaseous diffusion and ion implantation, right, and gaseous -- 11:34:28 11:34:31

Q I was asking about specifically techniques that remove unwanted diffused material after a gaseous im -- dopant step. 11:34:38 11:34:44 11:34:51

MR. De BLANK: Objection. Vague. Outside the scope of the report. Incomplete hypothetical. 11:34:56 11:34:57 11:34:59

A I can envision a number of techniques. How well they would work, I don't know. Okay? But I've given you two examples here; one that would provide sidewall contamination and one which would not. 11:35:00 11:35:02 11:35:05 11:35:12 11:35:15

Q So going back to paragraph 61, you said -- and correct me if I'm wrong -- that the unwanted short circuit is synonymous with the contact, and so the "prevents the contact" means to prevent the unwanted short circuit? 11:36:05 11:36:12 11:36:21 11:36:28 11:36:32

A Yes. 11:36:35

Q Is that prevention generally synonymous with your interpretation of the term "isolation"? 11:36:35 11:36:45

MR. De BLANK: Objection. Vague. 11:36:50

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A Maybe you can clarify. 11:36:54

Q When you said earlier that isolation 11:36:55

means preventing the current paths -- 11:36:57

A Unwanted contact. 11:37:02

Q -- I believe you said, is that basically 11:37:03

what "prevents the contact" is understood to be as 11:37:07

well? 11:37:13

MR. De BLANK: Objection. Vague. 11:37:13

A Well, by "isolation," you mean inability 11:37:16

to -- one other way to look at it is an inability 11:37:23

to communicate either electrically, mechanically, 11:37:27

whatever. You want to render two regions 11:37:31

physically separate so that they can't interact 11:37:33

with one another in one way or another is another 11:37:36

way of looking at it. 11:37:40

Q I guess my question is, when you 11:37:45

interpreted the plain and ordinary meaning of the 11:37:46

term "isolation," the claim term says "an 11:37:51

isolation portion for preventing a contact." Is 11:37:55

"preventing a contact" synonymous with 11:37:58

"isolation"? 11:38:03

MR. De BLANK: Objection. Vague. 11:38:05

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A Yeah, I -- the purpose of the structure shown in Figure 2 is to use these mouse snips to cut the wire that might allow for interaction between the emitter and the underlying backside field region. So I mean that if you want to -- it's a break, a break in a potential conducting path. 11:38:07 11:38:18 11:38:22 11:38:27 11:38:33 11:38:39 11:38:42

Q Okay. 11:38:44

MR. ROTHENBERG: U.S. Patent No. 5,218,211. Introduce Exhibit 5. 11:38:44 11:39:32

(Exhibit 5 was marked for identification and is attached to the transcript.) 11:39:36 11:39:36

A Yeah. One of my many patents. 11:39:44

Q Are you a named inventor on this patent? 11:39:54

A Yes, I am. 11:39:56

Q Do you recall working on this invention? 11:39:59

A Sure, yeah. Yeah, Mike and I worked it. 11:40:01

MR. De BLANK: Just wait for the question. 11:40:07 11:40:08

THE WITNESS: Okay. 11:40:09

Q You can -- you can you recall working on it? 11:40:12 11:40:15

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A Yeah. Yes, I do. 11:40:16
Q If you look at Figures 6 and 7? 11:40:26
A Yeah. Yes. 11:40:36
Q If you look at column 2, line 24? 11:40:55
A I'm getting there. 11:41:08
Q You can -- 11:41:18
A 24, I gotcha, okay. 11:41:19
The presence of particles is determined 11:41:21
by comparing observed continuity with expected con 11:41:23
-- observed continuity with expected continuity. 11:41:29
Okay. So -- 11:41:32
Q You can refer to -- you can use this if 11:41:33
you want to refer to the text. I know it's on two 11:41:36
sides of the same page, so if you want to look at 11:41:39
it -- 11:41:42
A Okay, thank you. 11:41:43
Q Is 6 and 7 -- should those labels be 11:41:47
reversed -- 11:41:51
MR. De BLANK: Objection. Vague. 11:41:53
Q -- on the figure? 11:41:54
A It was a long time ago. 11:41:56
Q Just if you read column 2. 11:41:57

A Particle on negative resistance during exposures results in an electronically open, an electrical open, okay. 11:42:01 11:42:04 11:42:10

So it's saying defining the structure with a negative resist which hardens when exposed. Okay. And so the -- so where the negative -- okay. So -- okay. All right. 11:42:11 11:42:16 11:42:24 11:42:37

So you see what's happening here is that there's negative resist, they're going to -- tried to harden into a pattern using exposure, photo exposure. Okay? Then -- but unfortunately, a particle will sit on the photo resist preventing it from being exposed. Okay. 11:42:43 11:42:48 11:42:51 11:42:56 11:43:02 11:43:07

So -- and so, okay, the underlying layer when you do the etch to define the -- this metal strip between these two contact pads, it's that there's no protection, and so it etches through and you get that break which I guess is called 51. Okay. 11:43:09 11:43:17 11:43:21 11:43:26 11:43:29 11:43:35

And this black striped ugly thing, okay, is the particle that prevented the resist from continuously being formed and allowed for the 11:43:35 11:43:40 11:43:46

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break to occur on etching. So yeah, I don't -- I don't see -- okay, that looks all right to me. Yeah. Okay. 11:43:51 11:43:57 11:44:00

You want me to go back to 7? 11:44:00

Q What I'm asking is, you see Figure 6 is below Figure 7? 11:44:04 11:44:08

A Yes. 11:44:10

Q Now, if you look at the column 2 descriptions of 6 and 7, are those descriptions correct, or should 6 and 7 in the figures be reversed? 11:44:10 11:44:13 11:44:21 11:44:27

A Figure 6 is a schematic illustration of an embodiment where the particle sensor includes a positive resist over, over conductive film with an interlayer level isolation test structure wherein opaque particles cause underlying resist metal to short. 11:44:29 11:44:33 11:44:37 11:44:51 11:44:55 11:45:00

7 is a schematic illustration of an embodiment where the particle sensor includes a two-terminal conducting serpentine defined in a negative resist. And it remains soluble, resist remains soluble where the shadow of the particle 11:45:03 11:45:07 11:45:10 11:45:15 11:45:26

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and the presence of the particle is detected by an open. 11:45:32 11:45:36

All right. Okay. Scientific documents, patents included, are always difficult to interpret on the fly, okay? I will give you this. Those two figures may have been reversed, okay? I mean -- and to further support your hypothesis over here, the -- normally the figures are presented top to bottom. Figure 6 would go on top, Figure 7 would go on the bottom, and the associated text would remain. 11:45:36 11:45:41 11:45:44 11:45:50 11:45:53 11:45:57 11:46:02 11:46:05 11:46:09

So it's possible that they were flipped, but I think, you know, a POSITA would, as you have done, would garner what the appropriate ordering ought to be. 11:46:13 11:46:19 11:46:24 11:46:28

And I mean we -- Mike and I had a number of discussions on this -- on this technique. We worked it together. Along with Lauren, who are now dead, and it was an interesting way to assess the density of defects in the resist film, yes. 11:46:28 11:46:34 11:46:38 11:46:43 11:46:51

What else can I say? 11:46:55

Q So I -- my question about this is if you 11:46:59

look at Figure 7 -- 11:47:02

A Yep. 11:47:03

Q -- there's these two portions, 43a and 43b -- 11:47:04

11:47:10

A Yep. 11:47:12

Q -- that are referred to as isolation segments? 11:47:14

11:47:17

A Well, those are the interdigitated finger electrodes. The goal is to discuss whether or not you form a short between those. Okay? The whole idea is that if you define -- let's say we -- we use photo resist to find the pattern. 11:47:23

11:47:24

11:47:32

11:47:38

11:47:48

What you want to do -- okay, suppose we use the positive photo resist to define pattern. Okay. Then the pattern would have to be formed by illumination in the region between the interdigitation. 11:47:55

11:48:00

11:48:05

11:48:10

11:48:14

Q And so why is the -- why is this metal residual particle causing a short circuit? 11:48:28

11:48:33

A Well, the idea is that it's preventing illumination of the region beneath it, and the resist requires illumination for exposure, and 11:48:37

11:48:41

11:48:49

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here there's -- so -- so what's going to happen is 11:48:58
that you're going to -- okay, that region, okay, 11:49:06
yeah, positive resis hypothesis makes sense here. 11:49:11
The particle itself is shielding the underlying 11:49:16
resist from exposure, and if it's a positive 11:49:23
resist, then the resist will cover metal and that 11:49:27
metal that's covered exists as a bridge between 11:49:38
43b and 43a. 11:49:42
You following me or should I -- okay. 11:49:43
Q So is 43 a defect? 11:49:48
MR. De BLANK: Objection. Vague. 11:49:52
Document speaks for itself. 11:49:53
A Sure. The answer is yes. 11:49:55
Q Yes? 11:49:58
A Yeah. 11:49:58
Q So the presence of a short circuit 11:50:00
indicates that a defect is present? 11:50:06
A Yes. 11:50:09
Q And so when 43a and 43b have no contact, 11:50:18
there's no short circuit, and then when they're 11:50:30
contacted, there's a short circuit? 11:50:33
A Yeah, when there's a short circuit, it 11:50:37

indicates the presence of a defect. 11:50:39

Q Are 43a and b oppositely charged or have some potential difference? 11:51:03 11:51:07

A It doesn't matter. You just want to establish a potential difference and see if you run a current. 11:51:08 11:51:12 11:51:14

Q So if you have a potential difference between two conductors, you can short them by contacting them at any given point? 11:51:21 11:51:28 11:51:38

MR. De BLANK: Objection. Vague. Incomplete hypothetical. The document speaks for itself. 11:51:41 11:51:42 11:51:44

A Sure, but -- you can form a conductive bridge, which would short the two test pads. 11:51:47 11:51:51

Yeah, I'm looking -- it should -- there should have been another line leading from the bottom statement, test pads. One line should go to the contact pad on the right, one should go to the contact pad on the left. They're both test pads. 11:51:57 11:52:02 11:52:05 11:52:08 11:52:11 11:52:15

And if you -- I mean you can see how the presence of defects during lithographic exposure 11:52:15 11:52:21

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would run the risk of shorting between those two interdigitated finger arrays, and that would mean that you'd effectively measure no resistance when you put an ohm meter between the two probes. 11:52:25 11:52:29 11:52:35 11:52:40

Q Going back to paragraph 60. 11:52:53

A Okay. 11:52:55

Q I think you can probably put that away. If you're trying to reduce clutter. 11:52:58 11:53:05

MR. De BLANK: Dr. Peckerar, keep the marked exhibit for yourself and return the unmarked page to Mr. Rothenberg. 11:53:23 11:53:25 11:53:28

MR. ROTHENBERG: Thank you. 11:53:31

Q I mean you can have it if you want, but I don't want to confuse the -- 11:53:31 11:53:33

A Something of nostalgia there. 11:53:35

Q You can have this copy there. 11:53:38

A 1993, wow. God. 11:53:40

Q And so the assignee of this patent was United States of America as represented by the Secretary of Commerce? 11:53:41 11:53:45 11:53:47

A Yes, Bureau of Standards is -- it was MBS at the time. It should still be MBS. 11:53:49 11:53:53

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Q This was during your work with the Navy -- the Navy branch that you mentioned earlier? 11:53:56 11:53:57 11:54:01

A Yeah, it was branch, yeah. 11:54:02

Q So looking at paragraph 60 -- 11:54:07

A Got it. 11:54:12

Q I apologize if this question is beneath you, but when it says -- so 170 and 120 are referred to as conductive-type semiconductor regions, so in a conductor is a conductor characterized by current can flow freely through whatever structure it has? 11:54:14 11:54:18 11:54:25 11:54:31 11:54:37 11:54:44

A That's one way of looking at it, yeah, sure. 11:54:47 11:54:50

Q So a conductor typically has one potential with reference to another, you know, anything that it's isolated from? 11:54:51 11:55:07 11:55:10

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 11:55:14 11:55:15

Q If you know what I mean. 11:55:17

A All right. Is a metal an equal potential, that's what you're asserting. A 11:55:19 11:55:26

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perfect metal which is a perfect conductor would be an equal potential. Of course, if there's any resistance present in the conductor, then there could be potential drops developed due to the structure itself. That would be -- 11:55:29 11:55:31 11:55:34 11:55:38 11:55:42

Q And is a semiconductor -- sorry. 11:55:46

Is an insulator generally characterized as current does not flow through it? 11:55:49 11:55:54

MR. De BLANK: The same objections. 11:55:57

Q How would you characterize an insulator? 11:56:01

A See that, you got to be really careful about all this stuff. 11:56:04 11:56:06

I mean, we clearly observe currents through insulators, even though insulator implies that it's a current block, okay, but, you know, when we're talking about Ado amps, it's still a conduction which we can measure, okay, believe it or not. 11:56:07 11:56:11 11:56:14 11:56:18 11:56:23 11:56:26

I mean -- so when you say "insulator," you're saying that you are -- the structure reduces conduction to the extent that would meet the requirement of the system you're trying to 11:56:26 11:56:33 11:56:36 11:56:39

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develop. 11:56:42

Q And so are these the phosphorus-doped 11:56:52

polysilicon layer electrically acts as a 11:56:57

conductors? 11:57:01

A That would be -- yeah, that layer would 11:57:02

be the backside field region I think you're 11:57:04

referring to. Yeah, that's a conductor, right. 11:57:08

Q And 120, also, the boron-doped region, 11:57:10

the boron doping makes it conductive? 11:57:16

A Yeah, that's the emitter, yeah. 11:57:21

Q And so because they're conductive 11:57:27

regions, if there's an unwanted contact, then 11:57:31

there will be a short circuit? 11:57:34

MR. De BLANK: Objection. Incomplete 11:57:37

hypothetical. 11:57:39

A It depends on where, right, of course. 11:57:39

Q If you have the patent handy -- 11:57:44

A '104? 11:57:52

Q Yeah, the asserted patents. 11:57:52

A Right, we've got '104 here. 11:57:55

Q That's fine. Okay. 11:57:57

A So that's what we need, okay, great. 11:57:59

Q So earlier on Figure 2 you see there 11:58:03
the -- you refer -- you were talking previously 11:58:05
about the I? 11:58:08
A Yeah. 11:58:11
Q Now if you turn to Figure 3. 11:58:11
A Yeah. 11:58:22
Q Are you familiar with Figure 3? 11:58:22
A Yeah. 11:58:24
Q Are you -- do you understand this is 11:58:32
looking from the bottom of the solar cell? 11:58:39
A Let me make sure. I think that's right, 11:58:48
but let me make sure. Why am I not finding -- 11:58:50
Q Figure -- column 13, line 41, refers to 11:59:33
Figure 3, at least. I think it's referred to in 11:59:42
other places. 11:59:45
A Line 41. The isolation portion may be 11:59:47
formed in the entire edge of the back surface, 11:59:50
yep. And may have a closed shape as shown in 11:59:53
Figure 3. Yeah, it's got to be closed, right. 12:00:00
Furthermore, the specific step or 12:00:08
operation is present between portions in which the 12:00:12
isolated portion I and the tunnel layer 160 and 12:00:16

the first conductive type semiconductor 170 have been formed. Okay. 12:00:22 12:00:27

Q Just to orient ourselves, in Figure 2 we were looking from the side, and now we're looking at the bottom? 12:00:34 12:00:36 12:00:39

A Yeah, that's what it seems to be, right. As I recall, yes. This is across -- 2 is a vertical cross-section, this is a plane view. It's a plane view of the backside, yeah, because you see it's labeled 160, the tunnel layer, and -- which lies beneath the backside diffusion, the backside field layer. 12:00:40 12:00:48 12:00:51 12:00:55 12:00:59 12:01:03 12:01:12

Q And you see I and D1 labeled? 12:01:14

A Yeah. Yep. 12:01:18

Q Do you understand D1 to be a width of I? 12:01:22

A It looks that way, yeah. 12:01:30

Q So D1 is the distance from the edge that I is inset? 12:01:50 12:01:56

MR. De BLANK: Objection. Document speaks for itself. 12:02:00 12:02:01

A True. But I would say -- I wouldn't -- what you see over here is -- okay, let's -- 12:02:03 12:02:09

Q How would you describe what -- 12:02:15
A Okay. 12:02:16
Q -- D1 is? 12:02:16
A Yeah, I'm getting -- okay. I wouldn't 12:02:17
term that as an inset. We're not -- we're not 12:02:24
creating -- the mouse snip exists right at the 12:02:29
edge of the wafer, okay? 12:02:35
So now you can say, well, the second 12:02:38
boundary is inset from the wafer edge, but you -- 12:02:43
and you can argue that there are two boundaries 12:02:50
here, one right of the wafer edge and one inset 12:02:54
from the wafer edge, but I don't believe that 12:02:57
would be consistent with the meaning of the patent 12:02:59
interpretation. 12:03:01
What I see over here is the mouse snip 12:03:03
which is at the wafer edge, not inset, okay, and 12:03:05
surrounding the cell itself. 12:03:10
Q I see what you're saying. 12:03:14
So please correct me if I'm wrong, but 12:03:26
the outer edge of I -- 12:03:30
A Yes. 12:03:37
Q -- is at the edge, and the inner edge of 12:03:38

I is inset from the edge, but in your opinion, you wouldn't say I is inset from the edge -- 12:03:42 12:03:49

A Exactly. 12:03:52

Q -- as a whole? Okay. 12:03:53

And is the inner edge shown with that dotted line in Figure 3? 12:03:58 12:04:10

A The inner edge is a hash -- is a hashed line, yeah. 12:04:14 12:04:21

Q Can you go column 13. 12:04:48

A Column 13. Okay. 12:04:53

Q Line 48. 12:05:05

A Column 13, line 48. 12:05:10

Q Can you read that through -- 48 through 58? 12:05:13 12:05:17

A "For example" it begins? 12:05:18

Q Yeah. And let me know when you're done. 12:05:20

A (Reviewing.) 12:05:23

Okay. 12:06:00

Q Would you agree the patent here is providing somewhat of a recommended range for D1? 12:06:03 12:06:07

MR. De BLANK: Objection. The document -- I'm sorry. 12:06:14 12:06:15

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MR. ROTHENBERG: I can rephrase. 12:06:16

If you can answer that question, you can 12:06:17

object. 12:06:25

MR. De BLANK: Yeah, objection, the 12:06:25

document speaks for itself. Vague. 12:06:27

A Okay, yeah, I -- I'm just looking -- 12:06:31

yeah, this is not a specification, okay, it merely 12:06:49

gives you a range. And it gives you suggestions 12:06:54

associated with the range. But it -- and for 12:06:58

example, it would be pretty not impossible to make 12:07:02

D1 10 angstroms, okay? 12:07:09

But in any event, okay, what a POSITA 12:07:15

would see in reading this would be, yeah, you can 12:07:20

make -- yeah, one millimeter seems reasonable. 12:07:22

Again, I'm hypothesizing, okay? Now -- 12:07:25

Q Were you going to finish your -- 12:07:41

A No, that was -- that's about all I have 12:07:42

to say about that. 12:07:45

Q My question was, you'd agree one 12:07:46

nanometer to one millimeter is a very large range? 12:07:50

MR. De BLANK: Objection, vague. 12:07:55

THE WITNESS: Sorry. 12:07:56

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A It's not necessarily -- well, it depends on what you mean by "large," okay? Is a millimeter doable by one method or another, probably. Is that large? It's a fraction of the total area of the wafer. It's -- it's a -- yeah. 12:07:56 12:08:04 12:08:06 12:08:13 12:08:18

Q I'm not -- I'm saying the patent doesn't give a very specific -- 12:08:24 12:08:28

A Dimension. 12:08:31

Q -- D1 to say that you have to use this dimension, right? It just gives a range? 12:08:31 12:08:34

MR. De BLANK: Objection. Vague. The document speaks for itself. 12:08:37 12:08:38

A But it does give you a range, right. 12:08:40

Q So how would a POSITA implementing this invention figure out what is the best D1 to use for a given solar cell? 12:08:44 12:08:49 12:08:53

MR. De BLANK: Objection. Outside the scope of the report. Incomplete hypothetical. Calls for speculation. Lack of foundation. 12:08:55 12:08:56 12:08:58

A Right, I could give you ways that I would make this. I would give you ways that I could measure it, okay? But I don't think that's 12:09:01 12:09:05 12:09:08

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relevant to the patent. 12:09:13

The patent is saying, well, you don't want to make it much bigger than a millimeter, because then you reduce the active area of the cell, and then if you make it too small, it doesn't work. It won't isolate. That's all that says. That's about as much as I'd be comfortable saying right now. 12:09:14 12:09:16 12:09:19 12:09:22 12:09:25 12:09:30 12:09:33

Q So is it fair to say you want to make it -- you don't want to make it bigger than necessary, but if it's too small, it's not going to do its job? 12:09:34 12:09:38 12:09:44 12:09:47

A It won't work. 12:09:49

Q And without going into specifics, would finding that right middle ground, if you're implementing this, be a matter of trial and error to figure out what is -- where that optimum distance would be? 12:09:50 12:09:57 12:10:00 12:10:02 12:10:08

MR. De BLANK: Objection. Incomplete hypothetical. Outside the scope of the report. Calls for speculation. 12:10:09 12:10:10 12:10:12

A I'm good at speculating. 12:10:14

The -- I mean how would you ascertain what -- you're asking how would you ascertain what the right dimension is, okay? And it does depend on a lot or a few things, okay? 12:10:15 12:10:34 12:10:38 12:10:46

I mean -- now, envision two conductive paths, okay, two resistors, one runs from the top of the cell through the load to the bottom of the cell, another runs from the top of the cell to the bottom of the cell without going through the load, okay? 12:10:47 12:10:54 12:11:00 12:11:04 12:11:11 12:11:15

You can calculate what the shunt current is going to be, and that's all, and if you ratio that to the total, total current, you get an efficiency for the layer. Okay? So you can do that. Okay? I don't know how -- how valuable it is. 12:11:15 12:11:20 12:11:24 12:11:28 12:11:33 12:11:36

I mean what I'm saying is I think, like I tell my graduates, it's always good to run the back-of-the-envelope calculation before you go stabbing around. 12:11:36 12:11:39 12:11:43 12:11:45

MR. De BLANK: It's been over an hour and a half and probably time for lunch. I don't 12:11:51 12:11:52

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mean to interrupt, but when you -- we should take a break when you're ready. 12:11:54 12:11:56

MR. ROTHENBERG: Yeah, that's fine. 12:11:58

THE VIDEOGRAPHER: We are going off the record. The time is 12:12 p.m. 12:11:59 12:12:00

(A recess was taken.) 12:12:03

AFTERNOON SESSION 12:12:03

THE VIDEOGRAPHER: We are back on the record. The time is 12:59 p.m. 12:12:03 12:59:52

BY MR. ROTHENBERG: 12:59:55

Q Dr. Peckerar, I think when we left off we were referring to Figure 3 of the patent, if you could open that up. 13:00:04 13:00:06 13:00:10

A Let's see. Okay. Got it. 13:00:11

Q And you understand that this is looking from the backside? 13:00:50 13:00:53

A Yes. 13:00:56

Q And we had discussed I and D1? 13:00:58

A Yes. 13:01:02

Q And you understand 160, 170 is referring to the back polysilicon internal layer? 13:01:10 13:01:16

A Yes, the polysilicon on top of the 13:01:22

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tunnel layer, right. 13:01:25

Q And there are basically electrodes even 13:01:27

on top of that? 13:01:36

A Yeah, yes. 13:01:38

Q And would you agree that I is formed as 13:01:44

the blank -- the space without -- without 13:01:49

electrodes going around the perimeter? 13:01:55

A I'm not clear on what -- 13:02:01

Q I think we discussed I as a width of D1 13:02:06

and D1 extends to some point, to some distance 13:02:09

inside the edge? 13:02:17

A Yes, if you refer back to Figure 2, yes, 13:02:17

you see I, you see the distance D1 specified. 13:02:20

Q And I'm just confirming that in Figure 13:02:24

3, that's shown as this white space (indicating) 13:02:31

around the perimeter? 13:02:36

A The region I, the extent D, it's shown 13:02:42

in the drawing as extending around the wafer, 13:02:47

right, the cell. 13:02:51

Q And so the claim term "an isolation 13:02:58

portion for preventing a contact" -- 13:03:03

A Yes. 13:03:07

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Q -- you don't despite that, or would you agree that this isolation portion is taught by the patent to be performing that function? 13:03:08 13:03:13 13:03:18

MR. De BLANK: Objection. Vague. 13:03:22

A I'd have to look at specific instances, and I'd have to do a little bit of checking, but it looks about right. 13:03:25 13:03:26 13:03:34

Q So you don't dispute that the isolation portion I taught by the patent can perform the function in the claim? 13:03:39 13:03:46 13:03:49

A Well, not by itself. It's how it's hooked into the rest of the structure. 13:03:51 13:03:56

MR. ROTHENBERG: Introduce Exhibit 6. 13:04:27

(Exhibit 6 was marked for identification and is attached to the transcript.) 13:04:27 13:04:27

Q So I have a pen here, but -- 13:04:37

MR. De BLANK: He's here to answer questions. I don't think he's going to need your pen. 13:04:41 13:04:42 13:04:44

MR. ROTHENBERG: If he wants to in his response, I can ask him questions -- 13:04:45 13:04:49

MR. De BLANK: Oh, sure, you can ask him 13:04:51

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but, Dr. Peckerar, you're here to answer questions, you should answer the questions verbally. The Court Reporter will take that and create the record. That's your role here. 13:04:52 13:04:55 13:04:57 13:04:59

MR. ROTHENBERG: He can make annotations if he wants. 13:05:02 13:05:04

MR. De BLANK: Why don't you ask questions and then we'll -- 13:05:06 13:05:08

MR. ROTHENBERG: Well, you can't tell him not to -- how to respond. 13:05:08 13:05:09

MR. De BLANK: If I could tell him -- Dr. Peckerar, you're here to answer -- excuse me. You're here to answer the questions posed. 13:05:10 13:05:10 13:05:13

Why don't you ask the questions, then we'll see where we go, but he's not here to create on the fly new things. I mean he's here to answer your questions. Ask him a question, he'll give you a verbal answer. 13:05:19 13:05:20 13:05:24 13:05:29 13:05:32

MR. ROTHENBERG: There's no rule that says he has to give a verbal answer. 13:05:34 13:05:35

MR. De BLANK: I think he does have to give a verbal answer. I mean that's literally the 13:05:37 13:05:39

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point of a deposition. 13:05:40

MR. ROTHENBERG: There is no rule that's limited to a verbal answer. If I ask a question and I ask a question that warrants an annotation or a drawing, if he can provide that answer with the annotation or the drawing, he can provide that answer. 13:05:42 13:05:43 13:05:45 13:05:50 13:05:53 13:05:56

MR. De BLANK: You're free to ask whatever questions you want, I'll make whatever objections I think are appropriate. 13:05:56 13:05:58 13:06:00

I don't -- I believe Dr. Peckerar is here to answer questions about the topics of his report, consistent with the opinions expressed therein. Your exhibit is an entirely new exhibit that doesn't seem to relate either to the topic of his report, the prior art in the report, or any of his opinions. 13:06:01 13:06:03 13:06:05 13:06:07 13:06:11 13:06:15 13:06:18

You haven't asked a question yet, I haven't instructed him to do anything. I'm telling you, however, that he's here to answer your questions, and I don't believe it's appropriate for him to create new material at this 13:06:18 13:06:20 13:06:23 13:06:25 13:06:27

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point.
MR. ROTHENBERG: You can make that objection, but you can't instruct him not to provide the annotation. 13:06:29 13:06:31 13:06:31 13:06:34
MR. De BLANK: Again, I'd suggest you ask whatever questions you want and I'll make whatever objections and instructions I believe are appropriate. 13:06:37 13:06:39 13:06:42 13:06:44
BY MR. ROTHENBERG: 13:06:44
Q Dr. Peckerar, if we remove the electrodes from Figure 3 and we look at where the first conductive-type semiconductor region 170, or the n-type region, is located, once we remove the electrodes and look at that layer specifically, would you agree Exhibit 6 accurately represents that layer in red? 13:06:50 13:06:57 13:07:05 13:07:20 13:07:27 13:07:32 13:07:44
MR. De BLANK: Objection. Vague. 13:07:50
A Go to figure 6. 13:07:53
Q No, Exhibit 6. This is Exhibit 6. 13:07:54
A Oh, right, okay. 13:07:57
Q Yes. 13:07:59
A Well, it certainly doesn't include or 13:08:19

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mention -- I mean you've got Figure -- you got item 170, which is the backside diffusion region, it's n-type poly layer. But you have no -- I remember -- okay, but you don't identify specifically the passivating layer 190A. Okay. So that's missing from the diagram. 13:08:25 13:08:30 13:08:35 13:08:48 13:08:57 13:09:07

And as we said before -- in my opinion, the isolation is a number of things. It's that region labeled I, which is the -- just the passivation layer 190A which, of course, contacts the silicon so that -- beneath it in the substrate. I don't see that indicated. Okay. 13:09:10 13:09:18 13:09:23 13:09:33 13:09:36 13:09:39

And then, okay, it links with the anti-reflection coating a number of other films, right? Not only 190A, 190B, okay. It's a rough outline, but it doesn't include all the elements. 13:09:45 13:09:50 13:09:56 13:10:07

Q Assuming isolation portion I includes the elements you think is necessary to include, would you agree that the isolation portion I in Figure 3 is extended around the perimeter such to isolate the n-type region from the edge? 13:10:19 13:10:23 13:10:27 13:10:33 13:10:42

MR. De BLANK: Objection. Vague. 13:10:50

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MS. SLADIC: What Figure 3 are we referring to? 13:10:55 13:10:57

MR. De BLANK: Sorry. That's the problem, you two are holding up two different exhibits, Mr. Rothenberg and the witness. 13:11:00 13:11:00 13:11:04

A Which is the one you're referring to? 13:11:11

Q You want me to repeat the question? 13:11:13

A Sure. And hold up the figure you're referring to. 13:11:15 13:11:19

Q So -- 13:11:19

A That's the one that I was holding up. 13:11:21

Q So you agree in this -- call this Exhibit 6? 13:11:23 13:11:29

A Yeah. 13:11:30

Q In Exhibit 6, the isolation portion extends around the perimeter to isolate the n-type polysilicon from the edge? 13:11:31 13:11:33 13:11:37

A Yes, but there are -- there are other films and materials necessary to complete the isolation portion as called for by the patent. 13:11:48 13:11:55 13:12:04

Q Assuming what's been labeled "isolation portion I" includes all of those films and 13:12:11 13:12:13

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materials -- 13:12:15
A Yeah -- sorry, I didn't mean to -- I 13:12:19
stepped on you again. 13:12:22
Q Assuming isolation portion I includes 13:12:24
all the films and materials you believe necessary 13:12:26
to achieve isolation, do you agree that the first 13:12:31
conductive semiconductor region 170, which is 13:12:37
shown in red -- 13:12:39
A Right. 13:12:41
Q -- is isolated from the perimeter by 13:12:41
isolation portion I which extends around the 13:12:46
perimeter? 13:12:48
A My only objection to what you're saying 13:12:50
is that I believe that the isolation portion is 13:12:52
what creates the isolation, and that includes 13:12:56
everything that's in the circle on Figure 2. 13:13:03
Okay, it seems to me that you're only 13:13:07
referring the region I, okay, and I would say that 13:13:10
this is a system that involves a number of 13:13:16
different structures to function adequately. 13:13:20
Q Would you agree that I, as you -- 13:13:34
however you define it, extends around the 13:13:38

perimeter in a closed shape? 13:13:41

MR. De BLANK: Objection. Vague. 13:13:46

A Well, ideally, the isolation would 13:13:53

isolate the whole structure from -- the whole 13:14:00

backside structure from the edge of the wafer. 13:14:04

That would be the ideal situation. 13:14:12

Q Is that what is shown in -- 13:14:21

MR. De BLANK: Sorry, let him finish his 13:14:26

question. 13:14:28

THE WITNESS: Okay. 13:14:28

Q Is that your understanding of how this 13:14:29

isolation portion I is configured? 13:14:33

MR. De BLANK: Objection. Vague. 13:14:35

A Given what I've just said about this 13:14:38

being a system, it didn't include a single element 13:14:41

and extended to the whole circle, I think that's 13:14:49

the intent of the patent. 13:14:52

Ideally, that isolation would -- would 13:14:58

surround the active region of the solar cell. 13:15:01

Yeah, but it's more than just I, okay. 13:15:05

Q I includes the passivation layer that 13:15:12

goes over it? 13:15:15

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A I would -- yes, that would be what's illustrated by I. 13:15:16 13:15:19

(Exhibit 7 was marked for identification and is attached to the transcript.) 13:15:20 13:15:56

Q So if we compare Exhibit 6 and 7 -- 13:16:11

A Yes. 13:16:16

Q -- in Exhibit 7, the isolation portion is only formed on half of the cell? 13:16:17 13:16:19

A What I've been given is Exhibit 8 -- no, that's Exhibit 7, okay, right, right. Okay. Yes, it looks as though. 13:16:23 13:16:28 13:16:31

Q So if the isolation portion were only formed on half this cell, would it still be able to prevent the contact? 13:16:35 13:16:37 13:16:40

MR. De BLANK: Objection. Incomplete hypothetical. Calls for speculation. Outside the scope of the report. 13:16:42 13:16:43 13:16:46

A I mean it would reduce the leakage, that's for -- it would reduce the shunt currents. But it certainly wouldn't eliminate it. It wouldn't be an effective -- it would be a partial remedy. 13:16:54 13:16:57 13:17:04 13:17:07 13:17:11

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Q Would it prevent the contact? 13:17:13

MR. De BLANK: Same objections. Calls 13:17:18
for a legal conclusion. 13:17:19

A In certain regions it would prevent the 13:17:21
contact, provided that we understand that that 13:17:23
blue region has to be extended to the other 13:17:26
materials as I mentioned. 13:17:32

Q But on the non- -- 13:17:34

A Assuming there's no pretreatment of the 13:17:35
surface, of the sidewall, then you would have a 13:17:39
conductive path, yeah. 13:17:49

Q A conductive path surrounding the half 13:17:53
in which it's not formed? 13:17:59

A There could be, yes. I mean could you 13:18:00
clarify a bit, perhaps? I mean -- if -- are you 13:18:12
saying that if you eliminate the whole circular 13:18:19
region and allow 160, 170, 190 to extend all the 13:18:23
way to the wafer surface -- I mean the wafer 13:18:30
sidewall -- would there be an isolation. Is that 13:18:36
the question? 13:18:40

Well, the isolation is included in that 13:18:42
circle, and what you -- and if you remove the 13:18:46

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circle and just do the physical extension, then you've eliminated the isolation portion. But you wouldn't completely eliminate it because it might -- it might be present on the right. 13:18:50 13:18:53 13:19:06 13:19:10

Q Do you interpret the term "prevent the contact" to require complete elimination of conductive paths? 13:19:26 13:19:27 13:19:33

MR. De BLANK: Objection. Sorry, I didn't mean to interrupt. Objection. Incomplete hypothetical, calls for a legal conclusion, outside the scope of the report. 13:19:34 13:19:35 13:19:38 13:19:39

A Whether or not this does the job depends on the spec you're working for. How much power do you want to deliver to the load, right? Clearly, by allowing the leakage path, the conductive path to exist on the left-hand side, you've compromised the function of the isolation. That doesn't mean you've negated it. 13:19:46 13:19:49 13:19:52 13:19:55 13:20:02 13:20:08 13:20:10

Q By "compromise function," do you mean not be able to prevent the conductive path? 13:20:29 13:20:32

A Not capable of eliminating the parasitic conductive path along the wafer edge. 13:20:39 13:20:43

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(Exhibit 8 was marked for identification and is attached to the transcript.)

Q So if the isolation portion were formed in small segments around the perimeter, would this feature be able to prevent the contact?

MR. De BLANK: Objection. Incomplete hypothetical. Calls for speculation. Outside the scope of the report.

A To my mind it would compromise the isolation. It wouldn't eliminate it.

Q So the isolation ability would be compromised?

MR. De BLANK: Same objections. Vague.

A It would be compromised, but to what extent would be uncertain, and whether or not it rendered the cell useless due to the extreme amount of parasitic currents, it would be compromised.

Q Is there any situation that a solar cell such as this one could prevent a short circuit?

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Outside the scope of the

report. 13:22:59

A Well, I repeat, it would compromise the function. Would the function be destroyed? That depends on what the specs are you're working for. I couldn't tell from this. 13:23:01 13:23:05 13:23:10 13:23:14

Q One more. 13:23:21

(Exhibit 9 was marked for identification and is attached to the transcript.) 13:23:21 13:23:32

Q So if the feature were formed only at one single point, would you agree in that case that that single point would fail to prevent a contact? 13:23:32 13:23:43 13:23:49 13:23:53

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Outside the scope of the report. 13:23:54 13:23:55 13:23:57

A Well, it would more seriously compromise the function. Again, you'd have to tell me exactly how -- how long and how wide this blue structure was, where it extended, I can make a more educated guess. But this would be a severely compromised device. 13:24:00 13:24:03 13:24:06 13:24:12 13:24:17 13:24:20

Q Let's say it were -- comprised less than 13:24:24

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0.01 percent of the perimeter. 13:24:27

MR. De BLANK: Sorry. Sorry, I hadn't 13:24:36

registered on your questions. Same objections. 13:24:38

Vague. 13:24:41

A If it only passivated, or if it -- 13:24:46

sorry, to use -- if it only isolated that much of 13:24:48

the periphery, it wouldn't be much of an isolation 13:24:55

portion. 13:24:58

Q So you agree it wouldn't be an isolation 13:25:02

portion in that case? 13:25:04

MR. De BLANK: Objection. Misstates the 13:25:06

testimony. Same objections. 13:25:07

A It wouldn't be much of an isolation 13:25:09

prevention. 13:25:14

Q Last question on that. 13:25:37

Would there be any scenario which you 13:25:38

would be able to prevent a contact? 13:25:43

MR. De BLANK: Objection. Vague. 13:25:45

Incomplete hypothetical. Calls for speculation, 13:25:45

calls for a legal conclusion. 13:25:49

A Yeah, I'm not sure what you're referring 13:25:51

to. Which of these drawings? Oh, this last 13:25:53

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drawing? 13:25:56

Q Yeah. 13:25:58

A That's a hypothesis that -- and I would be reluctant to make. It depends on what the requirement is. 13:25:59 13:26:04 13:26:07

Q I'd like to switch gears a little bit back to your report, if you could take that out. 13:26:35 13:26:39

A Okay. Okay. 13:26:45

Q If you go to page 21. 13:26:49

A Okay. 13:26:58

Q Here, starting at 68, is your description of the Chang reference? 13:27:04 13:27:06

A Yes. 13:27:17

Q And if you go to page 71 -- or sorry, paragraph 71, on page 22. 13:27:17 13:27:21

A Yes, I've got that Chang was specifically addressed. 13:27:30 13:27:33

Q Yeah. Did you review the '419 patent? 13:27:34

A This one does not stand out particularly in my mind, but I seem to remember it was one of the family of '104 and '009 patents. 13:27:55 13:27:58 13:28:01

Q I believe that's correct. 13:28:07

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And in this paragraph you're noting how the Examiner brought up Chang during the prosecution of that a patent? 13:28:08 13:28:13 13:28:20

A Right. 13:28:22

MR. ROTHENBERG: So if I could introduce Exhibit 10. It's U.S. Patent No. 10,014,419. 13:28:23 13:28:33

(Exhibit 10 was marked for identification and is attached to the transcript.) 13:28:40 13:28:40

A All right. 13:29:02

Q And as you said, you understand this patent to be in the family of the asserted patents? 13:29:19 13:29:22 13:29:25

A Yes. 13:29:25

Q And here in paragraph 71 you're talking about, in the second sentence, a removing step in the '419 patent? 13:29:33 13:29:36 13:29:48

A '419, okay, which page are you referring me to? 13:29:52 13:29:55

Q If you go to column 38. 13:29:56

A Okay. 13:30:06

Q Line 29. 13:30:07

A 38, line 29. Okay. 29 you say? 13:30:15

Q Yeah. 13:30:22
A Wherein the removing step further 13:30:23
compromises forming an isolation portion by 13:30:27
removing the tunnel layer in the side of the 13:30:31
semiconductor substrate and edge portion of the 13:30:34
first conductive type. 13:30:37
Okay. Yeah. 13:30:39
Q Is this the removing step you refer to 13:30:45
in the second sentence of paragraph 71 of your 13:30:48
report? 13:30:53
A Here we go, here's 71. Okay. 13:31:12
Yes, this does call for removal of the 13:31:34
tunnel layer, yep. So basically we're going down 13:31:39
to all silicon in that region to the right of I. 13:31:52
Q And then you note -- the next sentence 13:32:23
of paragraph 71 you say: 13:32:27
During prosecution the Examiner 13:32:29
correctly noted that Chang does not teach or 13:32:32
render obvious the removing step. 13:32:43
MR. De BLANK: Object to -- it misstates 13:32:49
the document. The document speaks for itself. 13:32:50
A Right. I mean to my limited legal 13:33:07

knowledge, this -- this simply says that Chang doesn't teach the removal of the oxide in the fact that the -- the '104 package does explicitly state that, right? So the Patent Examiner noted that and allowed the previous patent so we discussed. 13:33:10 13:33:19 13:33:23 13:33:32 13:33:37

Q And -- 13:33:43

A Based on that. 13:33:43

Q And at the top of page 23 you continue and say: 13:33:45 13:33:49

Like the '419 patent, independent claim 1 of both asserted patents also claim ... 13:33:49 13:33:54

And then you list, including further '104 patent, an isolation portion that excluded the tunnel layer, and that continues? 13:33:59 13:34:09 13:34:11

A Yes. And it does, right. That's a distinctive feature, the removal so described. 13:34:13 13:34:16

Q If we go back to the '104 patent. 13:34:26

A Okay. 13:34:32

Q And we go to the claim 1 at the very end? 13:34:40 13:34:43

A Okay, hold up for a minute. Lot of paper here. 13:34:43 13:34:50

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Okay, here is '104. Where do you want me to go? 13:34:50 13:35:03

Q Column 38. 13:35:04

A Column 38. 13:35:05

Q Line 26. 13:35:07

A Almost there. 13:35:22

Column 38, line 26, okay. These are the claims. Okay. Which was the line you want me to refer to? 13:35:23 13:35:29 13:35:36

Q 26. It says: 13:35:37

Wherein the isolation portion excludes the tunnel layer. 13:35:38 13:35:41

A Yes. 13:35:42

Q So -- 13:35:43

A It's a claim, yes. 13:35:44

Q This is the claim. 13:35:46

So when you said the '419 patent -- the removing step of the tunnel layer in the '419 patent is like the -- is like the wherein the isolation portion excludes the tunnel layer, are you interpreting this claim language of the '104 patent to be an excluding step where the tunnel 13:35:47 13:35:57 13:36:02 13:36:09 13:36:13 13:36:20

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layer is removed? 13:36:24

MR. De BLANK: Objection. Vague. 13:36:27

Misstates the testimony. 13:36:28

A Yeah, I hate to ask you this. Ask 13:36:36

again. I just want to make sure I understand 13:36:38

exactly what the question is. I apologize. 13:36:41

Q No, you should. 13:36:44

So if we take column 38 -- 13:36:45

A Yep. 13:36:54

Q -- if you put the '418 patent -- '419 13:36:55

patent -- do you still have that? 13:37:01

A Yes, I do. 13:37:03

Q If you take that back out and go to 13:37:04

column 38, line 29. 13:37:07

A Okay, I'm '401 [sic], column 38, okay, 13:37:12

line -- excuse me, line? 13:37:21

Q 29. 13:37:23

A 29. Okay. 13:37:25

Wherein the removing step further 13:37:27

comprises forming an isolation region by removing 13:37:29

the tunnel layer on the side of the semiconductor 13:37:36

substrate and an edge portion of the first semi -- 13:37:37

first conductive type. Semiconductor region wherein the first passivation film covers ... 13:37:42 13:37:48

Okay. You asked me to read it; I did. 13:37:51

Q Okay. So -- 13:37:55

A What's the question? 13:37:59

Q So the '104 patent says: 13:38:02

Wherein the isolation portion excludes the tunnel layer. 13:38:05 13:38:07

The '419 patent says: 13:38:08

By removing step comprises forming an isolation portion by removing the tunnel layer. 13:38:10 13:38:16

A Same thing. 13:38:18

Q Okay. And that's why in paragraph 71 you're saying that logic of the Examiner for the '419 patent applies to the asserted patents? 13:38:20 13:38:22 13:38:31

MR. De BLANK: Objection. Vague. 13:38:38

A To my mind, they teach the same thing. 13:38:43

Q Okay. 13:38:46

A You want to eliminate the -- the tunnel layer before putting the passivating layer down. It's the recipe. 13:38:49 13:38:52 13:38:58

Q Could we go to paragraph 261 which is on 13:39:33

page 89 of your report. 13:39:40

A Okay. 13:39:42

Q You can put away the '419, if you want, 13:39:42

to clear space. We'll probably use the '104 13:39:47

again. 13:39:53

A Yeah, okay. Where were we -- we're 13:39:53

going to? 13:40:02

Q So starting at -- if we go back to 13:40:06

paragraph 260. 13:40:10

A Paragraph 260 of '104. 13:40:14

Q Of the report -- of your expert report. 13:40:17

It's on page 88. 13:40:19

A Okay, these are the claims, yes. 260. 13:40:32

These are the claims of the '104 patent. 13:40:35

Q And this heading states -- this is your 13:40:39

opinion about claim 1 of the '104 patent -- is not 13:40:42

obvious over Chang in view of Jin because neither 13:40:47

Chang or Jin, nor the combination of Chang and 13:40:52

Jin, teach or suggests limitations 1i through 1k. 13:40:55

Did I read that correctly? 13:41:00

A Yes, you read it right. 13:41:01

Q And then on the next page, on paragraph 13:41:03

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262, it says:
In particular, neither Chang nor Jin discloses, teaches or suggests at least the following limitations of claim 1.
And you again refer to 1i, 1j and 1k?
A Yep.
Q So for the obviousness combinations of Chang and Jin, these are the three limitations that you dispute?
A Yeah, I believe that's all correct, that these -- neither Chang nor Jin disclose these teachings as set forth here.
Q And you don't have any opinions that Chang and Jin satisfy 1a through 1h?
A Well, Jin, to begin with, doesn't have a tunnel layer, okay, so that's clear, okay?
Q If I can clarify. You don't have any -- you don't have any opinions that the combination of Chang in view of Jin satisfies limitations 1a through 1h?
A 1a through 1h. Let me go back here.
MR. De BLANK: Objection. Vague.

Compound. 13:42:59

A Could you direct me to 1a through 1h again? I'm sorry. 13:43:26 13:43:29

Q In paragraph 260 it's not labeled but -- 13:43:35

A Yeah. 13:43:43

Q -- they represent the limitations going up to 1i, which is an isolation portion for preventing. 13:43:43 13:43:46 13:43:53

A Right, yes. All of these are clear from the figure in '104. 13:43:59 13:44:02

Q So just trying to clarify which. It appears from paragraph 262 your dispute of Chang in view of Jin obviousness combination is with respect to the three limitations, 1i, 1j and 1k? 13:44:18 13:44:22 13:44:29 13:44:32

A Chang? 13:44:39

Q Right. 13:44:41

A Neither Chang nor Jin disclose the following limitations. Okay. 13:44:42 13:44:47

Q And my question is, you don't dispute limitations 1 through h? 13:44:50 13:44:54

A As I recall, this just refers to one aspect of the isolation layer, and I succinctly I 13:45:00 13:45:04

thought put down exactly which of the limitations I was citing to. So this is in particular, but not exclusive of. 13:45:12 13:45:16 13:45:22

Yeah, I mean -- sorry, the bottom line is neither Chang nor Jin teach or suggest an isolation portion, and Chang in particular is vociferous against it. 13:45:30 13:45:38 13:45:44 13:45:51

Q My question is, I don't in this report see you dispute the Chang/Jin combination for any limitations besides these three, and if you do, could you please tell me where that is or confirm that your dispute is with respect to limitations 1i, 1j, and 1k, for the Chang and Jin combination? 13:45:59 13:46:04 13:46:09 13:46:13 13:46:16 13:46:20

A I believe these were the main issues. I don't believe I excluded others, but these are the main issues why the combination fails. 13:46:27 13:46:33 13:46:38

Q While you may not have excluded others, is it fair to say that these are the only three limitations that you provided opinions about? 13:46:55 13:46:57 13:46:59

A These are the main ones. If we go through the others one by one, we might be able to see how the others are -- are not obvious. 13:47:02 13:47:05 13:47:11

Q But in your report you haven't provided opinions about the others, right? 13:47:22 13:47:24

MR. De BLANK: Objection. Vague. 13:47:26

A But I'm not stating that there wouldn't be objections. I'd have to look it over again. I just picked out ones that really stood out. It says, "at least the following limitations." 13:47:27 13:47:29 13:47:33 13:47:42

Q In terms of the opinions that you provided in your report, sitting here today, for the Chang/Jin combination, you have disputed 1i, 1j and 1k, accepting that while there may be other disputes, you have not put those disputes into this report? 13:47:53 13:47:56 13:47:58 13:48:05 13:48:10 13:48:13

MR. De BLANK: Objection. The document speaks for itself, vague. 13:48:14 13:48:18

A I would have to go through more of the material to demonstrate limit -- those limitations occurring in other sections, okay? But all I can say is you have these three limitations, and these are the main ones that neither Chang nor Jin disclose, and as they're not disclosed in this prior art, they're not combinable. 13:48:21 13:48:23 13:48:34 13:48:38 13:48:44 13:48:50 13:48:54

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Q And these are the three limitations for the Chang/Jin combination that you provided opinions about? 13:49:02 13:49:04 13:49:07

A These are the three. All I'm saying is it doesn't mean there aren't others. I would have to look more carefully, but I do believe that these are the main issues which preserves the integrity of the '104 patent. 13:49:08 13:49:10 13:49:13 13:49:15 13:49:20

Q While there may be others, you haven't provided opinions about those others in this report? 13:49:30 13:49:32 13:49:35

MR. De BLANK: Objection. Vague. Document speaks for itself. 13:49:36 13:49:37

A I believe I've answered that. I'm saying there may be other places and, as I recall, I did specify a number of other issues, but I'd have to go through the documents for that. I'm not -- I'm not excluding the possibilities, but clearly these three are most -- the most significant. 13:49:40 13:49:49 13:49:54 13:49:59 13:50:02 13:50:10 13:50:13

Q Did you have opinions about the Chang/Jin combination you didn't put into your 13:50:21 13:50:25

report? 13:50:28

A I would imagine that it is possible. I could go back over those patents and then go through the report and perhaps find other examples, but to my knowledge, I pulled out the most relevant limitations, described them, discussed them, and discussed their lack of obviousness of those elements of those claims. That's as much as I can say. 13:50:32 13:50:35 13:50:39 13:50:42 13:50:49 13:50:54 13:51:04 13:51:11

Q What do you mean, "most relevant limitations"? 13:51:25 13:51:27

A They're the most obvious, most egregious. Yeah. The requirement of the removal of -- the specification of the removal of the tunnel layers when present, and the fact that we have to have a -- have an isolation portion that prevents contact, and the isolation portion excludes the tunnel layer. Very important. Wherein the first passivation film covers the first surface. And the isolation portion. 13:51:28 13:51:31 13:51:37 13:51:40 13:51:51 13:52:01 13:52:05 13:52:08 13:52:11

So that all that does, of course, is it draws the figure into the -- into the claims and 13:52:15 13:52:20

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describes the limitations that derive therefrom. 13:52:28

Q Sitting here today can you point me to any section of your report that disputes that Chang in view of Jin suggests or teaches limitations 1a through 1h? 13:52:38 13:52:39 13:52:43 13:52:47

A How much time do you want to spend? 13:52:53

Q Can you just say the answer. 13:52:56

A I'm not going to say -- this is a -- took quite some time to provide, it's a over 350-page report, and there are other supporting materials. 13:53:04 13:53:09 13:53:15 13:53:20

These are the elements that I remember most clearly, and they are listed, and I can't with certainty say that there aren't other elements that address the 1a through 1h, okay? I can't say that with certainty. I'd have to go through the whole report again. 13:53:20 13:53:24 13:53:29 13:53:33 13:53:48 13:53:51

Q Could you please do that. 13:53:52

A Okay. 13:53:54

Q There's -- you'd agree there's a Table of Contents at the front, right? 13:53:56 13:54:00

A Yeah, but I wouldn't -- 13:54:02

Q So you agree Section I says Introduction? 13:54:04 13:54:07

A Okay. 13:54:15

Q If you go to the -- 13:54:15

A Okay. 13:54:17

Q -- very front -- 13:54:18

A Wait. First, let's make sure we understand here. 13:54:18 13:54:20

You want -- okay, you're saying that 1a is the solar cell comprising a semiconductor substrate. 1b is a tunnel layer on the first surface of the semiconductor substrate. Well, of course. 13:54:21 13:54:30 13:54:35 13:54:38 13:54:42

Q I'm not -- sorry, I'm not asking you to do opinions on the fly. I'm asking what is in your report. 13:54:42 13:54:45 13:54:48

MR. De BLANK: Yeah. Listen to Mr. Rothenberg's question and then do your best to answer that question. And, Mr. Rothenberg, maybe if you repeat your question. 13:54:50 13:54:52 13:54:55 13:54:58

Q If you go to the very front cover -- 13:54:59

A Yeah. 13:55:21

Q -- you have Introduction? 13:55:22
A Yep. 13:55:28
Q Qualifications? 13:55:28
A Yes. 13:55:29
Q Materials Considered? 13:55:29
A Yep. 13:55:31
Q Compensation? 13:55:32
A Yep. 13:55:33
Q Summary of Opinions? 13:55:35
A Yes. 13:55:36
Q Legal Standards, Level of Ordinary Skill in the Art, Claim Construction, Priority Date, Background of the Technology, Background of the Asserted Patents, Scope and Content of Dr. Banerjee's Asserted Prior Art References. Dr. Banerjee has not established that Scherff, Luque, Feldmann or Kyeong references here lies under prior art. Lack of motivation to combine, and a reasonable expectation of success. 13:55:36 13:55:40 13:55:47 13:55:51 13:55:56 13:55:58 13:55:59 13:56:04 13:56:09
Section XV, the asserted claims of the '104 patent are not obvious. 13:56:14 13:56:20
XV(A), the asserted claims of the '104 13:56:22

patent are not obvious in view of Chang. 13:56:29

Claim 1 -- Section XV (A)(1), claim 1 of 13:56:31

the '104 patent is not obvious over Chang in view 13:56:39

of Jin because neither Chang nor Jin or the 13:56:43

combination of Chang and Jin teach or disclose -- 13:56:46

teach or suggest limitations 1i through 1k. 13:56:49

Then we move to Section XV(B) on the 13:57:02

next page. The asserted claims are not -- of '104 13:57:05

are not obvious in view of Jin. 13:57:23

XV(B)(1), claim 1 of the '104 patent is 13:57:25

not obvious over Jin in view of Feldmann. 13:57:29

Then we go to XV(C) on Roman numeral 13:57:31

page 4, the asserted claims of the '104 patent are 13:57:39

not obvious in view of Cousins. 13:57:43

XV(D), the asserted claims of the '104 13:57:45

patent are not obvious in view of Hwang. 13:57:50

And Section XVI, on page Roman numeral 13:57:54

5, asserted claims of the '009 patent are valid. 13:57:59

Would you agree that Section XV(A)(1) 13:58:04

provides your opinions that claim 1 of the '104 13:58:27

patent is not obvious over Chang in view of Jin 13:58:31

because neither Chang nor Jin, or the combination 13:58:33

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of Chang or Jin, teach or suggest limitations 1i through 1k? 13:58:36 13:58:41

A All of those statements are true. 13:58:51

Q So if you disputed any of the limitations 1a through 1h, you'd expect them to be in Section XV(A)(1), correct? 13:58:55 13:58:59 13:59:04

MR. De BLANK: Objection. Asked and answered. Document speaks for itself. 13:59:09 13:59:11

A Right. 13:59:16

MR. De BLANK: Sorry, Dr. Peckerar, I don't know whether it's clear you were responding to me or responding to the question. 13:59:29 13:59:30 13:59:32

A I'm responding to the question. I mean the -- 13:59:33 13:59:36

MR. De BLANK: Okay. 13:59:36

A What he read is true, and what he read represents my opinions, and all I can say is that -- I mean I'd like rather go to the claim 1 itself, go to the claim elements in dispute, and we have solar cell comprising of a semiconductor -- this is A -- what you're terming 1a, right -- comprising semiconductor substrate, a 13:59:37 13:59:40 13:59:47 13:59:58 14:00:11 14:00:13 14:00:16

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tunnel layer on the first surface of the semiconductor substrate. A conductive type, okay. 14:00:22 14:00:23

So this is all setting the stage. Without these elements one couldn't realize these limitations in isolation for preventing contact, okay? Yeah, you have to specify that as a claim, which it is. 14:00:29 14:00:31 14:00:36 14:00:39 14:00:43

That's the way I read it. I'm not a legal expert, but the way I read it, these items are necessary steps for the assertions of limitations 1i through 1k. They set the stage. 14:00:44 14:00:49 14:00:54 14:01:02

Q Which is fine. 14:01:27

My question is, separate from 1i through 1k, do you have any opinions about 1a through 1h regarding the obviousness of Chang in view of Jin? 14:01:27 14:01:31 14:01:37

A First of all, you say in one case this is unnecessary because Jin doesn't have a ton of layers -- tunnel layer, it's not a TOPCon cell, so right off that, that takes -- that satisfies the limitations 1i through 1k. 14:01:45 14:01:50 14:01:55 14:01:58 14:02:10

Now, the -- what's the role of these other limitations, these other elements of the 14:02:14 14:02:18

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claim? Were these not -- these are necessary ingredients because were they not present, you couldn't execute limitations 1i through 1k. 14:02:21 14:02:28 14:02:32

Now, do I address these elsewhere in the report, it's a big report ... 14:02:37 14:02:43

Let me ask you, can you point to a place where I contradict that, where I say that these are not limitations associated with '104, they're not valid limitations? 14:02:53 14:03:00 14:03:03 14:03:11

Q We just went through the Table of Contents. I look at the report, this is the section about claim 1 of the '104 patent. 14:03:23 14:03:24 14:03:26

A Right. 14:03:29

Q Obviousness of Chang in view of Jin, and you say Chang -- neither Chang nor Jin discloses, teaches or suggests at least the following limitations of claim 1, 1i, 1j, 1k, and I go through this section and those are the three that you talk about. So I don't know why you're hesitant to say that these are the three that you dispute. 14:03:29 14:03:32 14:03:35 14:03:38 14:03:45 14:03:47 14:03:49 14:03:52

MR. De BLANK: Objection. Asked and 14:03:53

answered. Argumentative. 14:03:54

A I agree that these are asserted -- at 1i through 1k are asserted. Okay. Are there other places where these are discussed or mentioned or debated, I think I cited one. I mean the -- you know, the necessity for the removal of the tunnel layer, and I cite to Jin's document in which he shows no tunnel layer present, and that's mentioned in the body of the report. I'm at a loss. 14:04:01 14:04:05 14:04:09 14:04:16 14:04:23 14:04:30 14:04:37 14:04:43 14:04:53

Q So you may dispute other limitations in this report other than -- 14:05:00 14:05:03

A I may disclose other -- 14:05:05

MR. De BLANK: Let the question finish. 14:05:07

Q Chang in view of Jin section for claim 1 of the '104 patent is XV(A)(1), correct? 14:05:12 14:05:16

MR. De BLANK: Objection. Document speaks for itself, vague. 14:05:31 14:05:32

A (Reviewing.) 14:07:14

I looked it over, and I gave you the same responses I gave before. 14:07:14 14:08:07

Q So you don't see any disputes of 14:08:12

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limitations 1a through 1h of Chang in view of Jin after looking it over? 14:08:14 14:08:18

MR. De BLANK: Objection. Misstates the testimony. Asked and answered. 14:08:21 14:08:22

A I object to your characterization. I mean these are -- are clear -- clear claim limitations. They -- the limitations are shown as met in the '104 patent, and they are not met in Chang or Jin. 14:08:26 14:08:29 14:08:36 14:08:40 14:08:50

Q Which limitations are you referring to? 14:08:55

A I through k. 14:08:59

And these limitations stand on the pillar of a specific system structure which is shown in the claims set forth in paragraph 260, solar cell, et cetera, et cetera. These are specific film arrangements which lead to the realization or the limitations that I describe in 262. 14:09:02 14:09:05 14:09:10 14:09:21 14:09:29 14:09:33 14:09:38

I just don't know what more I can say. 14:09:39

Q Who wrote your report? 14:09:55

A I wrote it as part of a team. We had many meetings, we discussed the items that were at 14:10:00 14:10:04

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hand, and we arrived at the -- and I read over every part of the patent that was -- that became my document, but did I write every paragraph? No. It's 300 pages, and I had to absorb at least another 600 pages of documents. 14:10:11 14:10:17 14:10:22 14:10:33 14:10:38

Q You haven't read your whole report? 14:10:40

MR. De BLANK: Objection. Misstates the testimony. 14:10:43 14:10:44

A I just said I read the whole report. 14:10:45

Q Could you go to page 22. 14:10:50

A Okay, where? 14:11:17

Q You see at the top, Bausch & Lomb, Inc., v. Barnes-Hind/Hydrocurve? 14:11:21 14:11:22

A Is this 22? 14:11:29

Q Page 22. 14:11:30

A Yes, I remember that very well, right. Yes. More of a burden on Banerjee because the Patent Examiner did admit the patent, yes. 14:11:52 14:11:54 14:11:59

Q Did you read these cases? 14:12:02

A Did I read those cases? They're not part of my document. They are a statement of what those cases -- or summary of what they represent 14:12:04 14:12:06 14:12:08

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which was passed to me by counsel here. 14:12:11

Q So your counsel inserted these cases? 14:12:17

A As I said, this is a team product. I was involved at every step of that product. I read every step of that product. The document you're citing is not part of that product, but the result from that document was cited and is part of that product. I hope I'm being clear. 14:12:25 14:12:30 14:12:33 14:12:37 14:12:41 14:12:45

And plus, the fact that -- the statement which stuck in my mind quite well is there's more of a burden on your expert to claim obviousness because the patent was already approved and filed with the Patent Examiner. 14:12:49 14:12:53 14:12:57 14:13:06 14:13:13

Q So you didn't determine if these cases -- you have no opinion about whether these cases stand for the propositions they say they do? 14:13:24 14:13:31 14:13:36

MR. De BLANK: Objection. Vague. Misstates the testimony. 14:13:41 14:13:42

A I don't venture to say this, why would I doubt that. These are things that have already appeared, been reviewed by the Courts. I have no reason to doubt it. 14:13:50 14:13:52 14:13:55 14:14:04

Q But this -- 14:14:13
A And the -- 14:14:13
Q -- work product -- 14:14:14
MR. De BLANK: Let him finish his 14:14:16
answer. 14:14:17
A And the -- and the gist -- the meat of 14:14:17
what that paragraph says is quite clear. It is 14:14:24
obvious, okay? It says that you guys have a 14:14:29
higher burden with respect to proving obviousness, 14:14:31
seeing as this was an already granted patent. 14:14:38
Q The content of the words shown on page 14:15:03
22 was given to you by your counsel? 14:15:06
MR. De BLANK: Objection. Vague. 14:15:10
A Did I assign a title to the case 14:15:16
Bausch & Lomb, Incorporated, vs. 14:15:18
Barnes-Hind/Hydrocurve? No, I don't think anybody 14:15:19
specifically gave counsel those -- that wording. 14:15:26
I think this was just part of the document that 14:15:31
accrued following legal action associated with it. 14:15:34
Q But somebody collected these cases and 14:15:39
picked out these words to cite. 14:15:42
A Yes. 14:15:45

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Q Who is that person? 14:15:45
A Of course, that was counsel. I'm not a 14:15:48
lawyer. I don't spend my evenings reading 14:15:51
jurisprudence. I mean I read papers on 14:15:56
semiconductor and solar cell physics. That's how 14:16:06
I spend my evenings. 14:16:10
Q If you to back to paragraph 266, page 14:16:17
90. 14:16:29
A Thank you. Okay, say again. Which 265, 14:16:30
is that the paragraph? 14:16:48
Q The bottom of 2 -- last sentence of 266. 14:16:50
A "Because these conductive regions are 14:16:58
disposed at different sides," that's where you 14:17:01
want me to read? 14:17:03
Q Uh-humh. 14:17:05
A (Reviewing.) 14:17:06
Q Could you read -- 14:17:10
A That's the -- 14:17:10
Q -- the last sentence out loud? 14:17:11
A "Chang has no need for an isolation 14:17:13
portion." 14:17:17
Right. So that's why -- well, it's not 14:17:17

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obvious over another. It was -- Chang doesn't -- 14:17:30
Chang specifically teaches away from these 14:17:41
isolation regions. He says because they're 14:17:51
separate, they're naturally separate, claim 1 has 14:17:58
no need for the -- Chang has no need for the 14:18:08
isolation as required by claim 1, so there's no 14:18:13
point of bringing this in for preventing contact 14:18:15
between the polysilicon layer and the interlayer, 14:18:20
it doesn't happen. 14:18:26
Q If you look at Figure 1 of Chang above. 14:18:29
A Yes. 14:18:31
Q Is it your understanding that -- just to 14:18:33
clarify, Figure 1 shows -- so Figure 1 and Figure 14:18:39
8 are shown there? 14:18:43
A Yes. 14:18:45
Q Is it your understanding that Figure 1 14:18:48
and Figure 8 of Chang are showing the sidewall of 14:18:51
the solar cell? 14:18:55
A Yes. 14:18:57
Q What's the basis of that understanding? 14:19:02
A This is clearly a cross-section which 14:19:07
terminates at the wafer's edge. 14:19:10

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Q Isn't this just a schematic that shows the layered structure? 14:19:20 14:19:23

MR. De BLANK: Objection. Vague. Asked and answered. 14:19:26 14:19:28

A It does, but it is a cross-section, and that cross-section -- now, if you're -- maybe what you want to assume, which is just an assumption, that somehow these -- the wafer extends beyond the vertical boundaries as shown, okay, typically in drawings like this, to show that there's continuation, you'd see a wavy line or, in one case, it was like a Z. I think that was in Cousins. That's not happening here. These are the edges of the wafer. And there is no contamination, because the technique used prevented that. 14:19:29 14:19:32 14:19:39 14:19:42 14:19:48 14:19:54 14:19:56 14:20:00 14:20:02 14:20:05 14:20:16 14:20:23

Q What technique -- 14:20:24

A I believe he did -- 14:20:25

MR. De BLANK: Let him finish. 14:20:26

THE WITNESS: Oh, I apologize. 14:20:27

Q In your opinion, Chang discloses a technique for preventing the emitter from 14:20:29 14:20:32

diffusing to the sidewall? 14:20:38

A Right. 14:20:39

Q What technique is that? 14:20:40

A Well, ion implantation would be one. We said, as I recall, that is what he used but -- 14:20:42 14:20:50

Q Chang uses ion implantation and that results in the sidewall not being contaminated with dopants? 14:21:00 14:21:03 14:21:04

MR. De BLANK: Objection. Vague. Compound. Document speaks for itself. 14:21:07 14:21:08

A I'm saying in answer to your question, yes, that's what he's disclosing. 14:21:16 14:21:19

Q And ion implantation only forms the dopants where they're desired to be generally? 14:21:27 14:21:32

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 14:21:41 14:21:42

A Well, that's the goal. I mean, ion implantation shoots particles at a surface, and particles only have forward momentum, they don't have lateral momentum. 14:21:44 14:21:47 14:21:52 14:21:54

And so, at best, only a small fraction of the beam during the ion implantation process 14:21:56 14:22:00

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might pass across the sidewall, okay, but there's no lateral offset to the ion flow. So it would just go straight -- slip by the sides, not implant. 14:22:04 14:22:10 14:22:14 14:22:19

And even if there was some angular spread, the projected momentum normal to the wall which would lead to doping of the wall would be so small, the impurity ions couldn't enter the lattice, the silicon lattice. 14:22:19 14:22:23 14:22:28 14:22:32 14:22:37

Q So if Chang, instead of ion implantation used a gas diffusion process to diffuse its emitter layer, then it would need an isolation portion? 14:22:45 14:22:53 14:23:01 14:23:06

MR. De BLANK: Objection. Incomplete hypothetical. 14:23:07 14:23:08

A I'd have to -- it is true I'd have to look at the circumstance, how the processes were accomplished, but in general, if you use -- I will give you, if you use gaseous diffusion, you're going to contaminate the sidewall. 14:23:09 14:23:11 14:23:16 14:23:20 14:23:24

Q Going back to the sentence about -- the last sentence -- let me know if you want a break. 14:23:35 14:23:39

I'm not sure how long it's been. 14:23:41
MR. De BLANK: It's been almost an hour 14:23:43
and a half. I don't want to interrupt your flow. 14:23:45
I would appreciate a break soon. 14:23:48
THE WITNESS: Good idea. 14:23:52
MR. ROTHENBERG: I was just going to ask 14:23:53
a couple more on this, but I don't want to keep 14:23:58
you, so let's just take a break. 14:24:01
THE WITNESS: Okay. 14:24:03
THE VIDEOGRAPHER: We are going off the 14:24:05
record. The time is 2:24 p.m. 14:24:06
(A recess was taken.) 14:24:09
THE VIDEOGRAPHER: We are back on the 14:41:46
record. The time is 2:41 p.m. 14:41:46
BY MR. ROTHENBERG: 14:41:50
Q Dr. Peckerar, do you have paragraph 266 14:41:55
of your report in front of you? 14:41:58
A Yes, I do. 14:42:01
Q Okay. And in the last sentence you say: 14:42:02
Because these conductive regions are 14:42:07
disposed at different sides of the substrate, they 14:42:13
cannot form a short circuit and thus Chang has no 14:42:16

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need for an isolation portion as required by claim 1, quote, for preventing the contact between the polysilicon layer and the emitter layer, unquote. 14:42:20 14:42:22 14:42:27

Did I read that correctly? 14:42:30

A Yes, you did. 14:42:33

Q Assuming Chang has no conductive material on the sidewall as you state, would a POSITA not recognize that an isolation portion may still be necessary? 14:42:41 14:42:46 14:42:57 14:43:03

A I don't think so. 14:43:05

MR. De BLANK: Objection. Vague. 14:43:06

THE WITNESS: Oh, sorry. 14:43:07

A I don't think so. I think what's more, Chang is quite clear. He says, for these reasons we do not require or recommend. 14:43:08 14:43:12 14:43:16

Q So if it were assumed that the sidewall did not have diffuse material and you also included an isolation portion, would that isolation portion be for preventing the contact between the polysilicon layer and the emitter layer? 14:43:22 14:43:27 14:43:34 14:43:37 14:43:40 14:43:43

MR. De BLANK: Objection, vague, 14:43:44

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incomplete hypothetical, outside the scope of the report. 14:43:45 14:43:47

A I don't know why you would do that, to be quite frank. I mean if you don't have sidewall contamination, where would you -- why would you do it? The answer is no. 14:43:49 14:43:51 14:43:55 14:44:01

Q So for preventing the contact between polysilicon layer and emitter layer requires that the emitter layer has been diffused such that the isolation portion is preventing a contact between the polysilicon layer and the emitter layer? 14:44:16 14:44:19 14:44:23 14:44:36 14:44:40

MR. De BLANK: Objection. Vague, incomplete hypothetical, misstates the testimony. 14:44:44 14:44:45

A I'm learning all these horrible things about myself here. 14:44:49 14:44:52

Okay, where was I? 14:44:53

Okay. There has to be a path, a leakage path, that shunts current away from the load. That would necessitate an isolation portion. Chang does not exhibit anything like that. Nor does he claim anything like that. 14:44:58 14:45:03 14:45:08 14:45:16 14:45:21

Now, you can hypothesize other -- other 14:45:22

situations where you could create a short, but none of those are mentioned in any of the work we've gone over. 14:45:30 14:45:38 14:45:41

Q If you look at the next paragraph, paragraph 267. Do you recall this paragraph, or do you need a second to refresh yourself? 14:46:03 14:46:05 14:46:18

A Well, I should take a look at it. Got 268 -- oh, here we go. 14:46:22 14:46:33

Q 267. 14:46:35

A Yeah, I got it. Okay. Yes. 14:46:37

Q Do you recall this -- this -- the contents, you refreshed yourself? 14:46:47 14:46:51

A Yes, I remember that quite well. 14:46:53

Q Are you familiar with solar cells where the p and the n-type are on the same surface? 14:47:04 14:47:10

A Yeah, I saw a patent like that, yeah. I wasn't sure why you would do that. It certainly isn't the mode of choice, but okay. I mean it could be done, sure. You can get vertical transport. 14:47:15 14:47:18 14:47:22 14:47:26 14:47:30

Q And for those you would require isolation between the two layers on the same 14:47:31 14:47:38

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surface? 14:47:41

A I'd have to think about that. I -- I 14:47:46

mean you can make arrays of p injunctions and then 14:47:50

develop currents and you could -- you could run 14:47:54

isolations around each of the junction pairs, but 14:48:02

this is all hypothesis, and I don't even know -- I 14:48:05

mean I know in the patent I read, it seemed to 14:48:08

claim that it was possible, but I haven't seen 14:48:11

anything like that in practice or in the 14:48:15

literature. 14:48:17

Q So when it says in the paragraph you 14:48:21

quote -- 14:48:26

A Yeah. 14:48:27

Q -- because the emitter layer -- let me 14:48:27

start over. 14:48:30

Because the emitter area 20 and the back 14:48:32

surface field area 30 are not adjacent to each 14:48:36

other? 14:48:41

A Yep. 14:48:41

Q Does that mean they're not on the same 14:48:43

side, they're on opposite sides? 14:48:48

A They're -- in this case, that's what it 14:48:52

means, but the idea is physical separation. Right. 14:48:55 14:48:58

Q And then the next sentence says: 14:49:04

In addition, because the emitter area 20 and the back surface field 30 are entirely formed, thus no additional patterning and alignment process, thus -- let me restart that. 14:49:06 14:49:11 14:49:14 14:49:19

In addition, because the emitter area 20 and the back surface field area 30 are entirely formed, thus requiring no additional patterning and alignment processes. 14:49:29 14:49:31 14:49:35 14:49:38

A Right. Not -- 14:49:42

Q So in your opinion, did you consider that Chang here in paragraph 76 is teaching to -- teaching that the emitter layer 20 and the back surface field area 30 are entirely formed? 14:49:46 14:49:56 14:49:58 14:50:07

A We're talking about 76 now? 14:50:10

Q Yeah -- it's paragraph 267 of your report, but it quotes paragraph 76 of Chang. 14:50:13 14:50:16

A What should I go to? 14:50:22

Q It quotes 76, so if you go to 267 of your report. 14:50:23 14:50:28

A Okay, all right. Yeah, right. Right. 14:50:29

Q So it says that: 14:50:34

In addition, because the emitter area 20 and back surface area 30 are entirely formed, thus requiring no additional patterning and alignment processes. 14:50:40 14:50:42 14:50:48 14:50:51

A Right, they're formed over the surface of the substrate, yes. 14:50:51 14:50:57

Q So what -- what is your understanding about the term "entirely formed"? 14:51:00 14:51:02

A They cover the surface. I mean there are exceptions listed, but none that are relevant to the work at hand. 14:51:05 14:51:11 14:51:14

Q Isn't one of the exceptions that "entirely formed" means entirely formed except for isolation regions? 14:51:18 14:51:21 14:51:33

MR. De BLANK: Objection. Misstates the document. 14:51:34 14:51:36

A My document, yes. 14:51:39

Those exceptions are never illustrated or pursued in discussion in the body of the patent, in the Abstract or in the claims. 14:51:40 14:51:44 14:51:47

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(Exhibit 11 was marked for identification and is attached to the transcript.)

Q Exhibit 11 is PRIORART_00000668? 14:51:50

A Right, yes, Chang patent. 14:52:18

Q Which is the Chang patent. 14:52:20

A Yes. 14:52:21

Q So paragraph 56 of Chang. 14:52:51

A All right. Paragraph 56. Okay, got it. 14:52:59

I want to go over to another, too, later, but -- 14:53:11

Q Here it says the tunnel layer is entirely formed over another surface; for example, the back surface. 14:53:15 14:53:18 14:53:21

A Yep. 14:53:23

Q And it says: 14:53:25

As used here in the expression, "entirely formed" means that an element such as a layer is formed over an entire surface without an empty area or non-coverage area or is formed in an entire area excluding predesignated or inevitably formed region such as periphery region, isolation region or the like. 14:53:26 14:53:29 14:53:34 14:53:38 14:53:43 14:53:50 14:53:55

Did I read paragraph 56 correctly? 14:53:56

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A Yes. 14:53:59

Q And so would you agree that when Chang says, "As used here in the expression, entirely formed means," that the following text is a definition of the term "entirely formed"? 14:54:06 14:54:08 14:54:12 14:54:16

MR. De BLANK: Objection. Vague, document speaks for itself. 14:54:20 14:54:22

A It means what it says, okay, entirely formed, over the whole surface. He -- in a blatant attempt to expand the scope of the patent, they add the possibility of other layers, which might, for one reason or another, not be covered, but in the patent itself, as I said earlier, I think, in the body of the patent, in the Abstract and in the claims, there is no specific mention of or description of that kind of coverage, or lack of coverage. 14:54:26 14:54:29 14:54:33 14:54:37 14:54:40 14:54:44 14:54:48 14:54:51 14:54:55 14:54:58

Q But you'd at least agree that Chang recognizes isolation regions may be formed? 14:55:04 14:55:07

MR. De BLANK: Is that the end of your question? 14:55:15 14:55:16

MR. ROTHENBERG: Yeah. 14:55:17

MR. De BLANK: Sorry. Objection, vague, misstates the document. 14:55:17 14:55:19

A Okay. He mentions those as a possibility. He doesn't explain or develop those ideas and -- and as I said, this is a pure hypothesis on his part, or on the people who wrote the patent. It's just an attempt to expand the scope. But it is not shown here in practice. 14:55:24 14:55:35 14:55:40 14:55:48 14:55:51 14:55:56

Q And if you look at paragraph 62, it says that: 14:56:11 14:56:16

The back surface field area 30 may be entirely formed over the second tunnel layer. As used here in the expression, "entirely formed" means that an element such as a layer is formed over an entire surface without an empty area or a non-coverage area, or is formed in an area excluding predesignated or inevitably formed area such as periphery region, isolation region or the like. 14:56:16 14:56:20 14:56:23 14:56:27 14:56:30 14:56:35 14:56:39 14:56:45 14:56:50

Did I read paragraph 62 correctly? 14:56:50

A You did. 14:56:53

Q And so you'd agree also with the back 14:56:54

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surface field 30, it at least does recognize it may include an isolation region? 14:56:59 14:57:03

MR. De BLANK: Objection. Misstates the document. The document speaks for itself. Vague. 14:57:06 14:57:08

A And I make the same argument that I made before. These are -- there's no evidence of or development of that idea in the patent, no figure shows it. And "fully formed" -- there is a clear and present meaning to "fully formed," fully formed over the whole surface. 14:57:11 14:57:13 14:57:18 14:57:22 14:57:28 14:57:31

Q Do you mean "entirely formed"? 14:57:44

A Yes. I apologize. 14:57:45

Q Would you agree that when a term has a general understood meaning and the patent provides a more specific meaning, that the more specific meaning should control? 14:57:57 14:58:02 14:58:05 14:58:08

A Provided the patent is explicit in its description of that language. I mean if you're going to use language in a very specific way which departs from the major use, then you'd have to explain what you're talking about. 14:58:11 14:58:15 14:58:19 14:58:24 14:58:29

Q So you're interpreting the term 14:58:55

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"entirely formed" in Chang according to its ordinary definition? 14:58:56 14:59:01

A Yeah. Yes. 14:59:03

Q One second. If you go to page 100. 14:59:56

A Yes. 15:00:40

Q Your opinion is that under any of these constructions Chang in view of Jin does not render obvious claim regardless of the construction? 15:00:47 15:00:51 15:00:56

A Claim 104; is that what you mean? 15:01:02

Q Claim 1. 15:01:05

A Claim 1 of '104, yeah, it doesn't render -- nothing here renders it obvious. 15:01:06 15:01:10

Q If you turn to page 102. C. 15:01:18

A C, okay. "I understand that Adani," that's how it begins. 15:01:36 15:01:39

Q You understand that Adani, the Respondents, have advanced an alternative construction that you identify here? 15:01:41 15:01:43 15:01:47

A I see it. 15:01:53

Q And you say it does not appear to make sense? 15:01:56 15:01:59

A (Reviewing.) 15:02:05

Well, first of all, before we get further into this one and we will, okay, it talks about inset, and we talked about what inset means, that the whole structure is transported inward rather than a single boundary, so I think that's the common parlance on that. 15:02:14 15:02:17 15:02:20 15:02:25 15:02:29 15:02:33

Q Going back to our earlier discussion of Figure 3, you would agree that the inner edge of the isolation portion is a distance inset? 15:02:45 15:02:46 15:02:52

A That one boundary, but to say that the feature -- if you want to call this an apparatus, the apparatus is inset, then both boundaries would have to move together. 15:02:57 15:03:01 15:03:04 15:03:07

Q If you could go to paragraph 358. 15:03:51

A Okay, in my report. What page is that? 15:04:01

Q Actually, 364. 15:04:10

A Oh, 364. 15:04:12

Q It's on page 121. 15:04:15

A Okay. I'm close. 15:04:17

You said it was 124, and which -- okay. 15:04:18

MR. De BLANK: I think he said page 121, paragraph 364. 15:04:38 15:04:40

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A 121. Jin, Feldmann and Respondents, okay. 15:04:42 15:04:58

Q Do you agree that the paragraph heading here says: 15:05:02 15:05:02

Claim 1 of the '104 patent is not obvious over Jin in view of Feldmann because neither Jin, Feldmann or the combination of Jin and Feldmann render obvious limitations 1f, 1i, 1j, and 1k? 15:05:04 15:05:08 15:05:11 15:05:14 15:05:18

A I see that, yes. 15:05:22

Q I read that correctly? 15:05:27

A Yes. 15:05:29

Q And if you turn the page to paragraph 367 on page 122. 15:05:36 15:05:39

A 367 -- yeah, let me just finish this review. Okay, 36 -- 15:05:46 15:05:51

Q 7. 15:06:10

A 67. 15:06:11

Q So 1f says: 15:06:12

A first electrode formed on the first passivation film and connected to the first conductive semiconductor region through an opening 15:06:14 15:06:18 15:06:23

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in the first passivation film. 15:06:27

A Yes. 15:06:29

Q So you dispute the combination of Jin and Feldmann teaches this limitation? 15:06:33 15:06:36

A What the combination is trying to do, if I may, is strip off the back portion of Jin and replace it with Feldmann's TOPCon layer. And Feldmann's TOPCon layer does not ... 15:06:47 15:06:51 15:06:58 15:07:05

(Reviewing.) 15:07:28

So it's stripping off -- all right. Well, he's doing a whole bunch of stuff here that Feldmann specifically argues against, okay? Among other things, he's eliminating the metal back contact, which is critical to Feldmann, as he says. He's -- that's part 1. 15:07:34 15:07:57 15:07:59 15:08:04 15:08:11 15:08:14

Okay, I guess his claim is that would make a bifacial cell, but in point of fact the monofacial cell in many instances just as useful and attractive as the bifacial, okay, but then he's now -- and then he's proposing that he could take the backside field region, the phosphorus backside field region, and he could shrink it a 15:08:28 15:08:31 15:08:40 15:08:45 15:08:49 15:09:05 15:09:12

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bit, and that shrinkage would create an isolation layer T, but as I recall, Feldmann -- Feldmann doesn't -- doesn't use a diffused emitter, doesn't have the sidewall contamination, you can see that in the figure, in the original Feldmann, that Banerjee seeks to combine. And it would just be kind of a waste of space here, you know, just some region where you'd be free of the, of the collection area. 15:09:18 15:09:27 15:09:41 15:09:45 15:09:51 15:09:56 15:10:01 15:10:05 15:10:13

Q Sir -- 15:10:25

A Yes. 15:10:26

Q -- my question was, 1f says: 15:10:26

The first electrode formed on the first passivation film and connected to the first semiconductor region through an opening formed in the first passivation film. 15:10:30 15:10:36 15:10:38 15:10:41

Right? 15:10:43

A Yeah, okay. 15:10:45

Q So this is looking at the bottom electrodes? 15:10:46 15:10:51

A Bottom electrodes. 15:10:53

Q So is your dispute about 1f 15:10:55

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specifically, without getting into all your other opinions -- 15:10:59 15:11:03

A One -- 15:11:03

MR. De BLANK: Let -- 15:11:03

THE WITNESS: Oh. 15:11:03

Q Just asking about the electrodes for now. I understand you have other opinions, but just focusing on your dispute of 1f, your dispute is that in the proposed combination, Feldmann's back metallization would be used instead of Jin's? 15:11:03 15:11:07 15:11:10 15:11:16 15:11:21

A Right. 15:11:27

MR. De BLANK: If you finished your question, I -- sorry, are you finished? 15:11:30 15:11:31

THE WITNESS: I'm sorry. 15:11:32

MR. De BLANK: No, because I would interpose an objection. 15:11:33 15:11:35

Q I was going to say Jin's finger electrodes. 15:11:37 15:11:39

MR. De BLANK: Objection. Misstates the document, document speaks for itself. 15:11:40 15:11:42

A Okay. Feldmann is very vociferous in this area speaking against what he calls point 15:11:44 15:12:12

contacts. These point contacts, or these raised metal areas in initial Jin, that would be -- I think it says 120, and then that would be the passivating layer, and then there would be a hole through that to accommodate the actual point contact, the one item I just mentioned that Feldmann teaches so violently against. 15:12:16 15:12:19 15:12:25 15:12:31 15:12:35 15:12:40 15:12:43

And what -- and you can see in the combination, that would be the lower figure, the lower drawing, he's got point contacts, and those point contacts are conductive to the phosphorus-doped backside layer. So -- which would -- by the way, which Feldmann claims would create an inferior product. 15:12:47 15:12:59 15:13:04 15:13:11 15:13:19 15:13:27 15:13:33

So Feldmann -- at least one of this pair teaches against -- teaches away from this backside installation process to create a combination, that in hindsight Banerjee feels would satisfy the claims. 15:13:35 15:13:40 15:13:45 15:13:50 15:13:55

He's trying to create a structure that normally a POSITA would not create one that wouldn't function as well and one which is 15:13:55 15:14:02 15:14:09

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specifically taught against by Feldmann. 15:14:11

So I don't see how this would relate to 15:14:14

obviousness. A POSITA would not be drawn to this. 15:14:29

Q You don't dispute that those finger 15:14:34

electrodes that you called point contacts of -- 15:14:40

A Feldmann -- sorry. I'm a terrible 15:14:43

person. 15:14:49

Q You -- setting aside the argument you 15:14:50

just made, you don't dispute that Jin's point 15:14:52

contacts are a first electrode formed on the first 15:14:58

passivation film and connected to the first 15:15:02

conductive semi -- conductive type semiconductor 15:15:06

region through an opening formed in the first 15:15:10

passivation film? 15:15:13

MR. De BLANK: Objection. Vague. 15:15:14

Misstates the testimony. 15:15:17

A Jin has point contacts, okay, Feldmann 15:15:18

hates point contacts. It's as simple as that. 15:15:23

Feldmann teaches against it. He says that you -- 15:15:27

that distributed resistance of the 15:15:30

phosphorus-doped layer would be large -- 15:15:33

relatively large as compared to his metalized 15:15:36

backside. 15:15:40

And what's more, he doesn't really hold much stock in the mono versus bifacial argument, realizing that his cells would find many areas of application which are predominantly in the commercial arena. 15:15:41 15:15:47 15:15:51 15:15:59 15:16:03

Q Who is "he" when you say he doesn't really hold much stock? 15:16:11 15:16:12

A Feldmann. 15:16:14

Q Feldmann. 15:16:16

You acknowledge that Jin is a bifacial solar cell? 15:16:16 15:16:23

A In the presentation given here, yes. 15:16:25

Q What's the difference between bifacial and monofacial? 15:16:33 15:16:35

A The monofacial can only collect solar energy, light, and convert it to electricity on a single surface. The front -- we call it the front surface. 15:16:37 15:16:40 15:16:44 15:16:48

A bifacial will collect energy from both surfaces. 15:16:48 15:16:55

Q And Feldmann's a monofacial? 15:17:01

A Feldmann is monofacial because the back surface is covered with a reflecting aluminum layer. Reflective metallization. So light can't get through it. So you can't introduce light into the back of the semiconductor. 15:17:04 15:17:06 15:17:12 15:17:18 15:17:21

Q And the more light that a solar cell can collect, the higher efficiency -- 15:17:35 15:17:40

A Yep. 15:17:42

Q -- it has? 15:17:42

A (Nodding head.) 15:17:44

Q If you go to -- flip the page to page 125. 15:18:07 15:18:10

A 125, okay. 15:18:16

Q Paragraph 372. 15:18:23

A (Reviewing.) 15:18:29

Q Can you read that? 15:18:37

A To -- 15:18:38

Q To yourself. 15:18:39

A I'm doing that. 15:18:40

Q Okay. 15:18:41

A (Reviewing.) 15:18:43

Would Feldmann -- okay, I'm sorry. 15:19:21

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Q Does Feldmann ever mention its sidewalls, to your knowledge? 15:19:36 15:19:39

MR. De BLANK: Sorry, objection, document speaks for itself, vague. 15:19:47 15:19:48

A I mean if he mentions it, it's only in the context of saying that -- that the sidewalls are not necessarily contaminated which would obviate the need for an isolation. 15:19:50 15:19:53 15:19:58 15:20:02

Q But you haven't identified anywhere where Feldmann actually says that? 15:20:10 15:20:13

A Like I said, Feldmann never depicts or describes the emitter on any part of the cell but on the front side. Never describes it as being present on the edge such as that it wouldn't make sense. So Feldmann -- 15:20:15 15:20:19 15:20:22 15:20:26 15:20:29

Q Feldmann is a paper -- oh, sorry. 15:20:35

A Sorry, no, I'm through, sorry. 15:20:37

Q Feldmann is a paper about the improvements brought about by the passivated tunnel layer and polysilicon layer? 15:20:40 15:20:44 15:20:51

MR. De BLANK: Objection. Misstates the document, the document speaks for itself. 15:20:55 15:20:56

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A Feldmann's paper describes a TOPCon cell which is -- which makes use of a tunnel layer, and he has a specific arrangement of components to form that tun -- the tunnel layer and the rest of the device. 15:20:59 15:21:04 15:21:08 15:21:11 15:21:13

Q Go to paragraph 373. 15:21:28

A Got it. 15:21:32

Q It says: 15:21:33

A POSITA would therefore not have been motivated to attempt to add Jin's gap T to Feldmann's solar cell. 15:21:33 15:21:36 15:21:42

Did I read that correctly? 15:21:45

A Yes. 15:21:46

Q Are your opinions in this section providing reasons that support this conclusion? 15:21:57 15:22:04

MR. De BLANK: Objection. Vague. 15:22:08

A I think I -- in my opinion I did an adequate job of describing those. 15:22:10 15:22:13

Q So your opinions about lack of motivation that a POSITA would therefore not have been -- sorry, let me start over. 15:23:43 15:23:45 15:23:55

A POSITA would -- therefore would not 15:23:56

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have been motivated to add Jin's gap T to Feldmann's solar cell. 15:24:00 15:24:05

In support of that opinion, you say: 15:24:06

Neither Jin nor Feldmann motivate excluding the tunnel layer from the edges of the back surface. 15:24:09 15:24:16 15:24:19

Is that correct? 15:24:23

MR. De BLANK: Objection. Vague. Document speaks for itself. 15:24:27 15:24:28

A Here's the deal. If you've got solar cells which the inventors work, satisfy their goals, and for some reason you want to combine any number of these to claim that it satisfies all of the -- all of the claim limitations of the asserted cell, the one that we're looking for obviousness, I mean why would a POSITA sit back and read a paper like Lin -- like -- 15:24:32 15:24:43 15:24:47 15:24:54 15:24:58 15:25:06 15:25:09 15:25:15

Q Feldmann? 15:25:24

A Feldmann. 15:25:25

Why would he take Feldmann, which rattles and rails against every other part, for example, of Jin, says you can't take away my 15:25:25 15:25:29 15:25:32

backside reflector, you -- we hate these point contacts, that -- a conglomeration of articles, especially Feldmann, teach away and would frighten a POSITA away, and say, no, I don't want to do that, try to do something else. But then he wouldn't be a POSITA, he would be one of above-average skill. 15:25:37 15:25:42 15:25:54 15:25:59 15:26:02 15:26:04 15:26:08

Q Would you agree that Feldmann teaches an improvement over a back surface field? 15:26:13 15:26:18

MR. De BLANK: Objection. Vague. The document speaks for itself. 15:26:23 15:26:24

A Feldmann does have a back surface field. Feldmann -- that phosphorus-doped layer is the back surface field region. There -- 15:26:27 15:26:31 15:26:36

Q I'm saying would you agree that Feldmann's discovery of the tunnel layer and the polysilicon layer wasn't an improvement to the state of the art of back surface field at the time? 15:26:40 15:26:42 15:26:45 15:26:49 15:26:53

A No, it definitely was an improvement. 15:26:54

Q It was? 15:26:56

A Yes. Yeah. It jacks up the open 15:26:56

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circuit voltage. Say what you will. 15:27:00

Q Are you familiar with the 15:27:09

Fraunhofer Institute at all? 15:27:12

A Yes, I visited it. I didn't meet 15:27:14

Feldmann. I've been there when Hans Ruprecht was 15:27:17

the head, yeah. 15:27:23

Q Did you visit specifically the Solar 15:27:26

Cell Division? 15:27:29

A No, at that time, I was more interested 15:27:31

in compound semiconductors. 15:27:33

Q You agree they're an institute that's at 15:27:44

the forefront of solar cell innovation? 15:27:47

A Yeah, they're pretty good. I'm sorry. 15:27:50

Q In 375 -- 15:27:57

A Yep. 15:28:03

Q -- it says: 15:28:03

Dr. Banerjee appears to propose a 15:28:04

combination that assumes a POSITA would exclude 15:28:11

Feldmann's vital tunnel layer from a portion of 15:28:14

the substrate to arrive at the claimed isolation 15:28:18

portion. 15:28:21

And it continues on. Did I read that 15:28:22

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correctly? 15:28:27
A Yes. 15:28:28
Q So is your opinion here that because 15:28:39
Feldmann considers its tunnel layer to be vital, 15:28:41
that a POSITA would not exclude a portion of it? 15:28:46
A Right. Yes. 15:28:51
Q And the tunnel layer is vital because it 15:28:59
performs a passivation function? 15:29:04
A It performs a passivation function, but 15:29:08
I thought I made it clear elsewhere, what it does 15:29:11
really is it jacks up the open circuit voltage. 15:29:13
Q Is that because it provides passivation 15:29:21
and it only allows -- blocks -- it blocks minority 15:29:24
carriers? 15:29:33
(Court Reporter clarification.) 15:29:33
Q Why is it -- 15:29:33
A I'm sorry. 15:29:40
MR. De BLANK: Let him finish. 15:29:41
Q It seemed like you didn't like the 15:29:42
phrase of that question, so I was going to let you 15:29:45
phrase it the way you wanted. 15:29:47
Why is a -- why does Feldmann consider 15:29:49

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tunnel layer to be vital? 15:29:52

MR. De BLANK: Objection. Document 15:29:54

speaks for itself. Go ahead. 15:29:55

A Feldmann feels that the jacking up of 15:29:59

the tunnel layer is essential, and it's a good 15:30:03

thing, okay? But in addition, the -- at the time, 15:30:07

this is what was thought, okay, I'm talking about 15:30:18

at the time, okay? They felt that the oxide band 15:30:21

structure would reflect minority charge and reduce 15:30:32

minority charge current, and the open circuit 15:30:36

voltage goes -- is kT/q times a natural log of the 15:30:40

current over the minority current, okay, and so if 15:30:45

you lower the minority current, then you're going 15:30:48

to get a higher open circuit voltage, okay? That 15:30:51

was the wisdom at the time. 15:30:54

We can debate that all we want, okay? 15:30:55

But I'm not going to go against common wisdom, 15:31:01

especially back -- all right. Now -- okay, so 15:31:04

the -- that was the deal. 15:31:10

Now, the business about recombination 15:31:13

is, if you only have one sign of carrier that's 15:31:16

moving toward the barrier, then they can't -- 15:31:21

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there's no recombination because you have to have the opposing signing for two charges, mobile charges to annihilate one another. 15:31:23 15:31:26 15:31:30

So there is a reduction in leakage current which would be vertical current through the whole device, okay? So you're lowering the leakage current, you're lowering the -- you're thereby increasing open circuit voltage, reducing recombination. It's a win/win. 15:31:32 15:31:39 15:31:41 15:31:45 15:31:48 15:31:52

Q And would you agree that the overall percent of the tunnel layer you would be required to remove to create an isolation portion is a very small percent of the overall percent of the tunnel area? 15:32:08 15:32:13 15:32:17 15:32:26 15:32:28

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 15:32:29 15:32:30

A Yes, and it doesn't -- you got to strip the whole thing. Okay? You go down to the -- to the n silicon substrate, and then you put the passivating layer on that. That's how Feldmann -- I'm sorry, that's how '104 and '009 work. That's part 1. 15:32:33 15:32:40 15:32:47 15:32:52 15:32:55 15:33:07

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Part 2 is these layers are exceptionally thin. They're less than 50 angstroms. How are you going to etch with any degree of control 10, 20 angstroms and leave some behind. It's going to all go away. You know that's reasonable. 15:33:08 15:33:12 15:33:16 15:33:21 15:33:24

Q Sorry? 15:33:31

A You know that's reasonable. I shouldn't do that. 15:33:31 15:33:33

Q What -- 15:33:34

A Slap me. 15:33:35

Q What do you mean, it's going to all go away? 15:33:36 15:33:38

A If you try to dip it in an etch, okay, then you'd say you can remove reproducibly and uniformly a couple of atomic layers. And in the manufacturing operation like that used for semi -- -- for solar cells, that's probably not going to be possible. 15:33:39 15:33:43 15:33:48 15:33:55 15:33:58 15:34:02

Q Would you agree that a layer that thin, a tunnel layer, dopants can generally diffuse through it fairly easily? 15:34:10 15:34:16 15:34:20

MR. De BLANK: Objection. Vague. 15:34:22

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Incomplete hypothetical. Outside the scope of the report. 15:34:22 15:34:26

A It's certainly going to slow transport down. 15:34:29 15:34:33

Q But -- 15:34:35

A Will it stop it? That's a hypothetical. I mean clearly, current has to flow through the oxide in order to be collected to create power. So the -- 15:34:36 15:34:43 15:34:47 15:34:51

Q I'm referring to flow of dopants through a tunnel layer. 15:34:58 15:35:00

A Right. Again, it depends on the dopant, it depends on the density of the tunnel layer, it depends on what the defect structure is in the tunnel layer. It would depend on a lot of things. That's why I answered before it's hypothetical how much or if any of it would be slowed down. 15:35:01 15:35:09 15:35:11 15:35:16 15:35:19 15:35:23

Q You understand that the material of tunnel layers SiO2 has been historically used as a masking oxide? 15:35:36 15:35:38 15:35:44

MR. De BLANK: Objection. Vague. 15:35:52

A Yeah, SiO2 is a dopant mask, that's 15:35:55

true, but those layer -- those are not tunnel layers, those are thicker than a thousand angstroms. Yeah. 15:36:01 15:36:03 15:36:06

Q But the -- 15:36:08

A Yeah, the -- yeah, to form a diffusion barrier, you need something thicker and you might use nitride rather than oxide. 15:36:20 15:36:27 15:36:32

Q So you would agree that for SiO2 to act as a diffusion barrier it would need to be significantly thicker than the thickness of a typical tunnel layer? 15:36:35 15:36:40 15:36:43 15:36:46

MR. De BLANK: Objection. Incomplete hypothetical, vague, outside the scope of the report. 15:36:48 15:36:49 15:36:51

A To be an effective diffusion barrier, it would have to be considerably thicker than a tunnel layer. Yeah. 15:36:53 15:36:56 15:36:59

Q Going back to the tunnel layer in Feldmann, Feldmann's tunnel layer is provided over the full backside? 15:37:04 15:37:09 15:37:13

A Yes. 15:37:17

Q Would you agree that the amount of 15:37:22

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tunnel layer to be removed to form an isolation portion would be a small overall percent of the tunnel layer? 15:37:23 15:37:29 15:37:35

A I don't think you can remove a small portion. I don't think that there's any etch process that would -- that would just take -- take two or three at -- well, I mean remember Feldmann claims that his tunnel layer is 14 angstroms thick. That may be three mil. layer, something like that. I mean that's a pretty precise etch to take, but a fraction. 15:37:37 15:37:39 15:37:44 15:37:49 15:37:53 15:37:56 15:38:00 15:38:07

Q Doesn't the asserted patents describe exactly that? 15:38:13 15:38:15

MR. De BLANK: Objection. Vague, misstates the documents. 15:38:17 15:38:18

A I don't -- one generally -- sorry. 15:38:23

Q In your understanding in the claim 1 when it says to exclude the tunnel layer, are you understanding that to be excluding it to the same extent as the excluded polysilicon layer? 15:38:46 15:38:50 15:38:53 15:39:01

MR. De BLANK: Objection. Vague. 15:39:07

A They're removed, okay. You got -- you 15:39:10

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got the backside field layer sitting on the tunnel layer. So to get to the -- to the backside, to the tunnel layer, you got to go through the backside field layer, and so both would be removed, okay? 15:39:13 15:39:16 15:39:21 15:39:23 15:39:27

Now -- and you see that there's no -- in the drawings in '104 and '009, '104 and '009, there's no backside field region in that I layer, that I portion. 15:39:27 15:39:34 15:39:41 15:39:48

So -- so you're talking about stripping down to the -- down to the silicon. And then you put a -- put the oxide passivating layer on top of that, that minimizes leakage. 15:39:49 15:39:54 15:39:57 15:40:02

Q So is one of your disputes here that the excluding limitation in the patent is a removal step, and that Jin's shadow masking in contrast to a removal step would not be possible? 15:40:20 15:40:26 15:40:32 15:40:41

MR. De BLANK: Objection. Vague. Compound. Misstates the document. 15:40:45 15:40:46

A Can you describe that in some -- I'm not following. 15:40:48 15:40:51

Q Are you distinguishing fully providing a 15:40:52

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tunnel layer and then removing portions versus just not providing portions to begin with? 15:40:59 15:41:02

A No. The patent -- I think Feldmann is very clear. I mean he deposits the -- he deposits or grows the oxide and, you know, that -- and that's deposited over the whole wafer, okay, and then he puts down the n backside field layer, which similarly falls over the whole layer. 15:41:09 15:41:12 15:41:16 15:41:30 15:41:37 15:41:44

Q Would you agree that Jin's gap T serves to prevent electrical shorting? 15:41:57 15:42:00

A Well, that was his intent, yes. 15:42:06

Q And you would agree electrical shorting can potentially render the entire device inoperable? 15:42:09 15:42:14 15:42:17

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 15:42:18 15:42:19

A Well, it could, yes. 15:42:26

Q So if a POSITA had to choose between removing a very small portion of the tunnel layer and not removing a very small portion of the tunnel layer, you would acknowledge there's reasons for and against doing both? 15:42:27 15:42:31 15:42:38 15:42:41 15:42:47

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MR. De BLANK: Objection. Vague, compound. Hypothetical. 15:42:50 15:42:51

A I don't think there's any reason why you might remove part of the tunnel layer. I just -- I can't think of any. 15:42:53 15:42:55 15:43:01

Q Why do you think -- 15:43:05

A It's either there or not. 15:43:06

Go on, sorry. 15:43:07

Q Why do you think the patent -- the asserted patents claim excluding the tunnel layer? 15:43:09 15:43:14

A Well, I think they want to put the -- okay, I'm sorry, I'm going to wax poetic a little here. 15:43:21 15:43:24 15:43:31

Okay. The oxide is a particularly thin oxides, there's ooze of defects, absolute ooze, and you like to minimize the defects because they lead to recombination loss. They also lead to generation currents. You -- so you like the best, highest quality oxide possible. 15:43:31 15:43:38 15:43:44 15:43:48 15:43:51 15:43:57

So what they're going to do -- now, remember, when you're growing a 14 angstrom oxide, there isn't a lot that -- if you heat it up -- let 15:44:00 15:44:03 15:44:07

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me just point out, if you take a silicon wafer and you hold it in the air, it's going to grow what we call a native oxide layer immediately, and that layer will be almost 14 angstroms thick, okay? 15:44:11 15:44:14 15:44:19 15:44:23

So you got -- you can have gross area inhomogeneity across the layer, you can't really do much in the way of thermal treatment. If you continue oxidizing, if you make it any thicker, then you're going to cut off currents and you won't get anything out. 15:44:26 15:44:29 15:44:35 15:44:39 15:44:43 15:44:47

And so what you would do would be let's start from scratch, guys, okay, let's make -- you want to make a layer that will not pass charge, either horizontally or vertically. So let's put in a better oxide, which will be the passivate oxide. So the passivating oxide sits on the, on anti-silicon and that's it. It's fairly trap -- it's -- the defect situation is much better than in the case of the native oxide itself or the tunnel oxide. 15:44:48 15:44:55 15:44:59 15:45:03 15:45:07 15:45:16 15:45:20 15:45:28 15:45:32 15:45:37

Q Are you saying the oxide in the asserted patent is not a tunnel oxide? 15:45:50 15:45:53

MR. De BLANK: Objection. Misstates the testimony. 15:45:56 15:45:57

A At the time that those patents were written, it was generally considered to be a tunnel oxide. 15:45:58 15:46:02 15:46:05

Q So how does the patent teach an oxide that's much better than a tunnel oxide? 15:46:12 15:46:15

A I don't remember the exact wording in the patent, but the patent is very explicit that the tunnel oxide has to be removed. Why would you get rid of something that -- if it ain't broke, don't fix it. It's an extra step. 15:46:25 15:46:27 15:46:29 15:46:34 15:46:38

Q Do you mean removed from the edges or entirely removed? 15:46:46 15:46:48

A Removed from the isolation region. Yeah, that's what this is all about. 15:46:51 15:46:55

Q What do you mean it's an extra step? 15:47:13

A To do the removal, to -- it's a removal step. If you don't have to do it, why do it? 15:47:14 15:47:17

Q But the patent has to do it? 15:47:22

MR. De BLANK: Objection. Vague. 15:47:25

THE WITNESS: Oh, I'm sorry. You've 15:47:25

grown accustomed to this. 15:47:30

A The patent says you have to do it, yeah. 15:47:32

The claim -- the claim is explicit. 15:47:36

Q Earlier you said that Jin doesn't have a 15:48:20

tunnel layer? 15:48:23

A No. 15:48:25

Q You didn't say that? 15:48:27

A No, I did. 15:48:28

Q Okay. How is that relevant in your 15:48:30

opinion to respond to Dr. Banerjee's positions? 15:48:41

A It's not -- 15:48:49

MR. De BLANK: Objection. Vague. 15:48:50

A It's not a TOPCon cell. When you employ 15:48:51

different layers, layers structures in your 15:48:56

device, it requires different processes, different 15:48:59

temperatures, different materials, different 15:49:02

times. 15:49:04

And you don't -- in Jin's case you don't 15:49:06

have to remove -- you don't have to remove the 15:49:16

tunnel layer or any other layer? 15:49:22

(Exhibit 12 and Exhibit 13 were marked 15:49:29

for identification and are attached to the 15:50:16

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transcript.) 15:50:16

MR. ROTHENBERG: I'm not sure which is 15:50:16

which. 12 and 13 should be the institution 15:50:28

decisions in IPR 2025 00006 and IRP 2025 in 00007. 15:50:34

MS. SLADIC: Which one is 12 and which 15:50:56

one is 13? 15:50:58

MR. De BLANK: Can I see that for a 15:50:59

moment, please. 15:51:00

Exhibit 12 is IPR ending 06; Exhibit 13 15:51:01

is IPR ending 07. 15:51:07

MS. SLADIC: Thank you. 15:51:12

BY MR. ROTHENBERG: 15:51:12

Q Could you open Exhibit 12 to page 20. 15:51:13

First of all, have you read this 15:51:17

document? 15:51:23

A I know the results of the IPR 15:51:23

proceeding. Okay. 15:51:27

Q Do you see the fifth line down says: 15:51:39

Patent Owner attached the disclosures of 15:51:44

Jin and Feldmann separately, but we do not look at 15:51:49

Jin individually and separately from Feldmann 15:51:52

because, quote, the question in an obviousness 15:51:54

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inquiry is whether it would have been obvious to a person of ordinary skill in the art to combine the relevant disclosures of the two references, not whether each individual reference discloses all of the necessary elements. 15:51:59 15:52:01 15:52:04 15:52:07 15:52:11

Did I read that correctly? 15:52:13

A That's what it says. 15:52:16

Q So when you provided your opinion that Jin lacks a tunnel layer -- 15:52:20 15:52:27

A Yes. 15:52:29

Q -- aren't you reading Jin individually? 15:52:30

MR. De BLANK: Objection. Misstates the testimony and the document. 15:52:37 15:52:38

A (Reviewing.) 15:52:46

I believe I've said enough about why the combination is nothing suggestive of a combination, nothing motivating in the combination. 15:52:46 15:52:56 15:53:00 15:53:03

Q Do you dispute the combination of Jin and Feldmann would have -- 15:53:06 15:53:08

A I don't -- 15:53:11

Q -- a tunnel layer? 15:53:11

MR. De BLANK: Let him finish. 15:53:13

THE WITNESS: Oh, yes. 15:53:13

A Yes, go on. 15:53:15

Q Do you dispute that according to Dr. Banerjee's opinions, the combination of Jin and Feldmann would include a tunnel layer? 15:53:17 15:53:19 15:53:24

A Well, I guess we're getting into Holmes loose screw here. 15:53:30 15:53:35

One, Feldmann clearly states the need, and a POSITA in the field would know that the TOPCon cells with the tunnel layer were superior to others that were currently on the market. 15:53:36 15:53:43 15:53:49 15:53:52

I mean, what's more -- and so -- and Feldmann also doesn't have the problem of sidewall contamination. So there's no motive to combine. 15:53:54 15:54:09 15:54:11

Okay, if you claim that, for example -- well, I mean -- let me see if I follow your argument. You can correct me if I'm wrong here, okay? 15:54:22 15:54:25 15:54:29 15:54:32

I mean your argument here is that because -- because Jin doesn't contain a tunnel layer, that ostensibly it wouldn't conflict, it 15:54:32 15:54:35 15:54:43

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wouldn't be obvious over Jin, or over '104, '009. So that being the case -- I have to think this through.

So that being the case, you can combine Feldmann with this, get your tunnel layer, and since you're using Jin, you could use the isolation issue, but each of these patents talks against the other.

Each of these patents -- I mean the -- the Feldmann patent certainly disparages the use of a solar cell without a metallized backside. Feldmann complains about the use of point contacts.

And let's see. Similarly, there were contradictions between Jin and Feldmann. I'll have to think about what they were for a moment.

But as I said, these patents -- if you read these patents, one says let's do this, one -- the other says, let's do that, and they both say don't do that.

So one would not be motivated, I think -- no matter how you want to combine them or

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look at them separately, no one would be motivated to do that, that Jin/Feldmann combination. 15:56:50 15:56:53

Q And an example of that is you said Feldmann does not have the problem of sidewall contamination? 15:57:31 15:57:36 15:57:39

A Feldmann does not as disclosed, as shown. There's no -- there's no sidewall deposition that he speaks about, there's none in his figures, none in his Abstract, none in his claims. But I'm not taking these individually. I'm taking them as a group. They attack one another. They nullify -- one nullifies the other. 15:57:42 15:57:45 15:57:53 15:57:56 15:58:00 15:58:04 15:58:06

So one wouldn't -- I mean what's happened here is you've got a patent that demands a tunnel layer, okay? And that's the '104 and the '009, okay? And a few other things, okay? 15:58:10 15:58:14 15:58:21 15:58:29

And so if somebody sat down and thought, well, how can I just pick these -- pick a bunch of existing patents, stick them together and get something that fits all the claims and then say this is prior art, all in hindsight. 15:58:33 15:58:37 15:58:42 15:58:47 15:58:50

I just don't see that as motivating, 15:58:56

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especially since -- since they're not taken individually, but taken together, they argue with one another. 15:59:04 15:59:09 15:59:12

Q Do you dispute that Jin's emitter is formed down its sidewall to its backside? 15:59:16 15:59:19

A It could be, yeah. And that's why -- yeah. 15:59:23 15:59:28

What did I do with Jin. Ah. 15:59:30

Q I haven't introduced it yet, but if you'd like to look otherwise, there's a figure here, we could introduce it. 15:59:40 15:59:43 15:59:46

MR. ROTHENBERG: 14 is PRIORART Bates No. 00007755, which is Jin. 15:59:55 15:59:57

(Exhibit 14 was marked for identification and is attached to the transcript.) 16:00:04 16:00:04

Q If you go to Figure 3. 16:00:17

A Yeah, you can see the sidewall contamination creeping down the side, okay? And then you can see the need for the T, the T region, which -- which is Jin's version of a isolation -- 16:00:25 16:00:29 16:00:33 16:00:38

Q Isolation portion? 16:00:52

A No, no, no. Isolation portion, you 16:00:53

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remember, is preserved for -- for the '009 and '104 in my mind. Okay. 16:00:56 16:01:04

Q What do you mean it's reserved for -- 16:01:08

A Yeah. 16:01:10

Q -- '104 and '009? 16:01:11

A Oh, sorry, go on. I apologize. 16:01:13

Q What do you mean it's reserved for the '104 and '009? 16:01:15 16:01:18

MR. De BLANK: Objection. Vague. 16:01:19

A Okay. Yeah. It's reference -- the portion -- part of it is only referenced with respect to -- is only found, as I remember it, in the '009 or the '104 patents. So I like to keep that. 16:01:20 16:01:24 16:01:28 16:01:31 16:01:36

Like you were saying before, if you use specialized language, you have to define it. And I'm defining it now as a isolation region that is fabricated according to the '104 the '009 patent claims. So -- 16:01:36 16:01:40 16:01:45 16:01:49 16:01:54

Q You mean isolation portion? 16:01:56

A Isolation portion, yes. Didn't I say that? 16:01:58 16:02:00

Q I think you said isolation region. 16:02:01
A Ah, okay. See how hard it is to keep 16:02:03
language straight? 16:02:06
Q So you wouldn't consider Jin's isolation 16:02:10
region to be an isolation portion because 16:02:19
isolation portion is confined to the asserted 16:02:22
patent figures? 16:02:26
A Right. Yeah, it's confined to one 16:02:27
process flow. Okay. I mean, yeah, you want to 16:02:31
call -- if you would like to call Jin's isolation 16:02:36
a region, an isolation region, that's fine, as 16:02:41
long as -- then we'd all know what we were talking 16:02:45
about here. That's why I was making the 16:02:48
distinction. 16:02:50
Q Can you go to 377. 16:03:39
A 377. I think I have that up here. 16:03:43
Q Page 128. 377 of your report. 16:03:46
A Yes. Just putting all this in some 16:03:50
order. 16:03:55
The only reason that Dr. Banerjee offers 16:03:56
anywhere in his report to exclude the tunnel oxide 16:04:08
layer from the edges, that's where you're 16:04:11

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referring to? 16:04:14

Q Yeah. 16:04:15

MR. De BLANK: And just so we're clear, 16:04:15

I think it's paragraph 377. You mentioned page 16:04:17

377. I think just for clarity. 16:04:21

MR. ROTHENBERG: Correct. Correct. 16:04:21

Q Can you reread the first two sentences? 16:04:23

A (Reviewing.) 16:04:33

Yeah, okay, pretty well familiar with 16:04:33

that. 16:04:50

Q Just for the record, according to 16:05:01

Dr. Banerjee's opinion, that: 16:05:06

If the tunnel oxide layer were to extend 16:05:09

to the edge, the exposed portions of the oxide 16:05:12

could trap impurities and create negative fixed 16:05:16

oxide charges which could then create a p-type 16:05:20

inversion in the n-type base substrate leading to 16:05:25

a leakage path to the p-type emitter on the front 16:05:29

of the solar cell. 16:05:33

Did I read his opinion correctly? 16:05:35

A Yes, you did. 16:05:39

Q Do you dispute -- 16:05:42

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A Finish, I'm sorry. 16:05:49

Q Do you dispute that this is correct, or do you only dispute that he has not provided enough evidence for this statement? 16:05:52 16:05:55 16:05:59

MR. De BLANK: Objection. Vague. Compound. 16:06:01 16:06:02

A Well, what you said was certainly true, I mean for -- and I might add, okay, I mean this is highly speculative. If you think what I do is speculative, okay, this is really spec -- now, the -- first of all, the oxide charges of the Zhu defects. They generally take on a positive nature. 16:06:07 16:06:12 16:06:17 16:06:20 16:06:24 16:06:30 16:06:35

Okay, in my report, I've got a drawing showing a number of different types of defects there are. I believe we got it out of my textbook. 16:06:36 16:06:40 16:06:43 16:06:45

But the thing of it is that that -- and there's only one process that really can -- okay, you could probably find an impurity that would take on a negative charge and -- maybe chlorine or something like that, but to speculate that you got 16:06:46 16:06:53 16:06:58 16:07:01 16:07:07

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chlorine contamination, where is it coming from? 16:07:10
The interface states can charge negatively, okay, 16:07:13
but you don't have a well-defined interface here. 16:07:18
What he's assuming is that if you extend 16:07:21
the tunnel layer up to the -- up to the 16:07:27
contaminated side, okay, that the tunnel layer 16:07:33
would take on a negative charge and would thus 16:07:38
invert the silicon beneath it, which would create 16:07:42
a layer mobile positive charge which would 16:07:47
effectively render the dimension of TO -- it would 16:07:51
turn to T -- the T layer, the T isolation region, 16:07:56
to have zero thickness or it wouldn't be there 16:08:03
anymore. 16:08:07
So do I dispute it? I just think it's 16:08:07
incredibly speculative. I would lean to no, but 16:08:14
speculative. 16:08:33
MR. ROTHENBERG: How long has it been? 16:08:34
MR. De BLANK: An hour and a half. 16:08:42
THE VIDEOGRAPHER: We are going off the 16:08:45
record. The time is 4:08 p.m. 16:08:47
(A recess was taken.) 16:08:48
16:08:48

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(Exhibit 15, Exhibit 16, Exhibit 17 and Exhibit 18 were marked for identification and are attached to the transcript.) 16:08:48

THE VIDEOGRAPHER: We are back on the record. The time is 4:25 p.m. 16:25:36

MR. ROTHENBERG: Exhibit 15 has been marked as PRIORART_0006904. 16:25:39

Exhibit 16 has been marked as PRIORART -- PRIORART 15 is Cousins. 16:25:54

PRIORART -- Exhibit 16 is Feldmann, it's Bates No. PRIORART_00021294. 16:26:03

Exhibit 17 is a paper called "Laser Edge Isolation for High-Efficiency Crystalline Silicon Solar Cells". It's marked PRIORART_00013242. 16:26:28

And Exhibit 18 is a paper called "High Throughput Laser Isolation of Crystalline Silicon Solar Cells", Bates stamp PRIORART_00006919. 16:26:46

BY MR. ROTHENBERG: 16:27:09

Q Dr. Peckerar can you take out Feldmann, which is Exhibit 16? 16:27:53

A Got it. 16:28:01

Q And you acknowledge Feldmann teaches 16:28:10

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formation of a tunnel layer and a polysilicon layer? 16:28:15 16:28:18

A Yes, TOPCon cell. 16:28:20

Q Could you go to the second page, which is document page No. 271? 16:28:26 16:28:30

A Yes. 16:28:36

Q About a third of the way down (indicating.) 16:28:43 16:28:48

A Yes. 16:28:51

Q There's a sentence that says: 16:28:52

Then an ultra-thin chemical oxide layer was grown with a thickness determined to be about 14 angstroms by spectroscopic ellipsography [sic]? 16:28:54 16:29:06 16:29:09

A Ellipsometry. 16:29:16

Q Yes, ellipsometry. 16:29:19

A Yes. 16:29:21

Q How would such a tunnel layer generally be formed? 16:29:25 16:29:29

MR. De BLANK: Objection. Vague. Incomplete hypothetical. Outside the scope of the report. 16:29:31 16:29:35 16:29:38

A Well, I used to boil -- I boiled them. 16:29:46

I took the silicon wafers, and I put them in boiling water, and they would form an oxide, and the longer you boiled it, the thicker the oxide. And -- it wasn't the most efficient way, but it was a way. 16:29:49 16:29:53 16:29:59 16:30:03 16:30:06

Now, there are a number of ways that are used. That's speculation. These people have attempted to do CVD deposition, popular way of looking at it. Now, I know it's very expensive, not widely used, it would be atomic layer deposition, but there are a lot of ways. 16:30:10 16:30:15 16:30:19 16:30:27 16:30:31 16:30:35

Q And after that it says: 16:30:39

Subsequently a 20-nanometer thick phosphorus-doped silicon layer was deposited on both sides. 16:30:41 16:30:46 16:30:49

A Yeah. 16:30:52

Q Is that the polysilicon layer? 16:30:53

A Yes. 16:30:56

Q And when you're depositing an oxide such as a tunnel oxide and then another layer on top, would you generally do that in the same chamber or process step? 16:31:02 16:31:06 16:31:09 16:31:16

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MR. De BLANK: Objection. Vague, incomplete hypothetical, outside the scope. 16:31:18 16:31:19

A Well, I mean you could. I mean ideally, since the silicon surface is so reactive, chemically reactive, probably be a good idea. And, you know, you could first bleed SiO -- you could bleed steam into -- into the furnace and then put something like silane, S-I-L-A-N-E, silane gas in, and take out the steam. That would -- the steam would deposit as an oxide, then the saline would grow the silicon layer. 16:31:22 16:31:27 16:31:31 16:31:34 16:31:40 16:31:44 16:31:46 16:31:54 16:31:57

There are lots of ways to do it. 16:32:04

Q Lots of ways to subsequently grow an oxide layer than a polysilicon layer without having to manually remove the wafer and -- 16:32:09 16:32:12 16:32:16

A Right. 16:32:20

Q Okay. And when it says "subsequent" in that sentence I just read, the 20-nanometer thick phosphorus-doped Si layer was deposited on both sides, you don't -- you don't see any technique described that would remove or prevent this layer from being formed on the sidewall? 16:32:21 16:32:28 16:32:32 16:32:36 16:32:45 16:32:51

A I'd have to study the exact flow again, but there's nothing here that would create that situation, no. 16:32:55 16:32:59 16:33:07

Q Could we go to paragraph 448? 16:33:31

A Of my report? 16:33:37

Q Yes. Exhibit 1. 16:33:39

A Yes. 16:33:58

Q Would you agree that paragraph 448 says -- strike that. 16:33:59 16:34:03

Let me read 447 and 448. Would you agree that 447 and 448 say that: 16:34:08 16:34:12

Cousins, whether considered alone or in combination with any of Kyeong, Sugawara and Chang, does not disclose, teach or suggest every limitation of claim 1. In particular, none of Cousins, Kyeong, Sugawara or Chang discloses, teaches or suggests at least the following limitations of claim 1. 16:34:15 16:34:22 16:34:25 16:34:29 16:34:35 16:34:39 16:34:43

And then you list 1i, 1j, and 1k. 16:34:44

Did I read that correctly? 16:34:50

A Yes. 16:34:54

Q If we go down to paragraph 450, you -- 16:35:07

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you understand that Cousins teaches use of a edge isolation trench 111? 16:35:13 16:35:15

A Yes. 16:35:20

Q Do you have an understanding of what is an edge isolation trench? 16:35:23 16:35:26

A Yes. 16:35:29

Q What is an edge isolation trench? 16:35:29

MR. De BLANK: Objection. Vague. 16:35:33

A It's a trench dug into the silicon, typically by a laser; although, it could be developed by a chemical method, as it sounds. It just prevents lateral transport along a surface. You'd fall in the trench. Here's a wall of the trench, and you stuff -- try to push things this way and they go -- 16:35:39 16:35:44 16:35:48 16:35:57 16:36:03 16:36:08 16:36:13

Q Is that lateral transport of electrons in holes? 16:36:20 16:36:24

A Yeah, it could be, yeah, right. 16:36:26

Q So what is the purpose of preventing lateral transport of electrons in holes? 16:36:34 16:36:39

MR. De BLANK: Objection. Vague. 16:36:44

A Well, I mean the idea is that somehow 16:36:48

the conduction path -- you've got this p-type emitter and it's reaching around, and the contamination from the deposition of that emitter is reaching around, and we end up touching the underlying backside -- the underlying backside layer, and -- plus n portion in the back of the material. 16:36:53 16:36:58 16:37:03 16:37:06 16:37:23 16:37:33 16:37:39

And so what you're going to do here is you're going to try to break -- so you've got a conducting path that leads from p+ to n, which creates the parasitic diode which shunts out the power. So what you're going to do is try to block transport that goes through the diode. So one way to do it is to dig a trench. 16:37:39 16:37:42 16:37:45 16:37:49 16:37:56 16:37:59 16:38:02

Q If you go to paragraph 458 of your report. 16:38:14 16:38:21

A 458, yes. 16:38:36

Q Are you there? 16:38:40

A Yes, I'm sorry, I'm there. 458. 16:38:41

Q 458. 16:38:45

A Oh, I'm -- oh, wow, okay. 16:38:47

Q It didn't look like the right page. 16:38:53

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A No, sorry. 16:38:54
Q No problem. 16:38:56
THE COURT REPORTER: Paragraph, Doctor. 16:38:56
Q We'll get there. 16:39:14
A I'm really almost there. 16:39:15
458. It should be noted that it was 16:39:40
known in 2015, as well as today, that trenches 16:39:42
created by ... 16:39:46
(Reading.) 16:39:50
Yes. Yep. 16:39:50
Q Is it -- 16:39:55
A Well -- sorry, go on. 16:39:58
Q Is it your opinion that specifically 16:40:03
Cousins' isolation trench is leaky? 16:40:06
A It's very difficult to make a leak-free 16:40:14
isolation. It is possible, but in this particular 16:40:19
case when you have a -- that trench is going to 16:40:24
worm around the whole periphery of the wafer, and 16:40:30
to make -- to treat that trench so that it's 16:40:34
uniform, has low leakage, is going to be very 16:40:41
difficult. 16:40:45
I'm just mentioning that a POSITA at the 16:40:45

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time would be very much familiar with STI, shallow trench isolation, which is routinely used in most processes, and would know how difficult it was to make a leak-free trench, and a trench that long would be very, very difficult to keep leak-free. 16:40:50 16:40:55 16:40:58 16:41:01 16:41:07

Q So at the end of this paragraph it concludes with: 16:41:22 16:41:26

A POSITA, both at the time of the invention of the asserted patents and thereafter, would not have been motivated to use this technique as it would not improve cell performance. 16:41:26 16:41:30 16:41:33 16:41:36 16:41:39

A That would be my belief. I mean I certainly wouldn't be motivated. I would say oh, boy, that's a hell of a process. 16:41:40 16:41:42 16:41:45

Q But were you going to add more or -- 16:41:52

A No. 16:41:55

Q You acknowledge that Cousins does explicitly teach to use one? 16:41:57 16:42:01

A He does. 16:42:03

Q So when you say, "A POSITA would not be motivated to use this technique," are you saying a 16:42:05 16:42:09

POSITA would not be motivated to use -- a POSITA reviewing Cousins would not be motivated to use edge isolation trench 111? 16:42:12 16:42:18 16:42:22

A My feeling is that you would look at that process and say ugh, it's going to take a while to develop. That would be my first reaction. That's not to say it couldn't be done. Apparently Cousins feels that he had some success with it. 16:42:31 16:42:33 16:42:37 16:42:40 16:42:43 16:42:47

I might try it out, but it would take much experimentation -- even if it could be done, it would take much experimentation and optimization to make that happen over those large peripheries. 16:42:47 16:42:50 16:42:53 16:42:56 16:43:10

Q So is it your opinion that a POSITA reviewing Cousins would understand that edge isolation trench 111 would not be effective and they would decline to implement it? 16:43:21 16:43:24 16:43:30 16:43:33

A It would be the last thing that I would try. It would be very difficult. That would be my opinion. I mean STI, shallow trench isolation, is used routinely in the DRAM business and making 16:43:36 16:43:37 16:43:40 16:43:49

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trench capacitors for DRAMs, but it is very difficult to control the leakage, and those -- and the area where the peripheries are trench isolated are much, much shorter than the ones that Cousins is indicating here. 16:43:53 16:43:58 16:44:00 16:44:10 16:44:13

Q Did you provide any evidence of the poor performance results of edge isolation trenches you're referring to? 16:44:15 16:44:22 16:44:27

A Well, if we -- he does supply a recipe for the fabricating which he claims would allow you to have low leakage, but he nowhere demonstrates that. I don't see any specific data that he presents to indicate that there's -- that there's a significant reduction in the shunting current. 16:44:28 16:45:39 16:45:42 16:45:45 16:45:50 16:45:56 16:46:02

Q My question was, did you in your report provide any evidence that isolation trenches were known to be leaky? 16:46:06 16:46:10 16:46:15

A Just the basis of my 44 years of experience in the processing knowledge area. 16:46:17 16:46:20

Q But no documentary evidence cited in your report? 16:46:29 16:46:32

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A Well, with -- there's no documentary -- no convincing documentary evidence. Cousins has created a significant improvement. Now, he does show a recipe. I might try the recipe, but I would have very low expectations for its outcome. 16:46:33 16:46:34 16:46:40 16:46:44 16:46:49

Q You would expect a POSITA to try edge isolation trench 111 and then decline to implement it? 16:46:55 16:47:01 16:47:06

A I would say it would take a lot of process optimization to quench the leakage from those STI. 16:47:07 16:47:11 16:47:16

But also, he doesn't -- I mean moreover, he doesn't break the contact between the p+ parasitic dopant and the underlying n+ layer. The trench is inset, and I think the claims in the '104, '009 -- I'm sorry, in Jin -- the claim is that the contact is broken, it's broken by the isolation. 16:47:18 16:47:32 16:47:38 16:47:44 16:47:55 16:48:06 16:48:16

Here the claim is the isolation -- the offending contact is not broken. You may get some improvement by reducing the leakage through the -- that would come from the whole expanded backside 16:48:16 16:48:21 16:48:29 16:48:32

layer, but -- backside field -- but in my mind, that wouldn't be sufficient in any event. 16:48:42 16:48:53

There's still that contact between the n and -- between the overlapping contaminating p layer and the -- and the n creating a parasitic diode which create a current load which prevent delivery of power to load. 16:48:55 16:49:01 16:49:06 16:49:19 16:49:22

Q Would you agree that this contact is broken with respect to the phosphorus layer that is within the trench? 16:49:27 16:49:29 16:49:35

MR. De BLANK: Objection. Vague. 16:49:38

A You are corroding the material, the backside field region with the laser, and you can't draw a leakage current directly from the remaining portion -- from the major portion of the backside field region, okay? 16:49:45 16:49:48 16:49:54 16:49:57 16:50:03

But you still have the n on the p from the contaminating diffusion incident on the n layer, and that would -- would create -- that leakage may be cut off, but that's a small portion of the -- of the whole surface. 16:50:07 16:50:16 16:50:22 16:50:28 16:50:33

Q By "a contaminating diffusion incident 16:50:36

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on the n layer," you're talking about the portion of the n that's outside of the trench? 16:50:49 16:50:51

A Yes. Yes. 16:50:55

Q Can you look at paragraph 456 of your report. 16:50:59 16:51:03

A Okay. 16:51:07

Q Should be there. 16:51:09

A 456. Yes. 16:51:11

Q So it says: 16:51:12

Additionally -- you're quoting Cousins as saying that as shown in Figure 1 the, quote, edge isolation trench 111, unquote, is, quote, formed through ... a portion of the substrate 101, unquote? 16:51:13 16:51:20 16:51:24 16:51:29 16:51:34

A Yes. 16:51:37

Q And that's a quote of Cousins' paragraph 19 in Figure 1? 16:51:38 16:51:42

A Yes. 16:51:43

Q And you say that: 16:51:47

In 457 a trench, quote, formed through, unquote, the substrate cannot be, quote, in an edge portion of the first surface of the 16:51:48 16:51:55 16:52:00

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semiconductor substrate, unquote, as required by limitation 1j. 16:52:03 16:52:09

A It's -- oh, I'm sorry, are you finished? I didn't mean to -- 16:52:11 16:52:16

Q I think the question is, what is the distinction between "formed through" and "in an edge portion"? 16:52:18 16:52:20 16:52:25

A Yeah, it's been -- the trench is displaced from the n portion. If you look at the '104 drawing, or the '009 drawing, Figure 1, I mean the -- in both cases, the -- you see that the isolation region, that mouse snip, it sits right at the edge of the wafer, right at the edge of the silicon. 16:52:26 16:52:28 16:52:34 16:52:43 16:52:51 16:52:55 16:52:59

Q Isolation portion -- sorry, cut you off. 16:53:00

A Sorry. 16:53:03

Q Isolation portion? 16:53:05

A Yes, the isolation portion sitting in that mouse snip which is right at the edge of the wafer. See, this -- this trench is displaced inward. I forgot the term that we used before. Maybe you remember. 16:53:05 16:53:07 16:53:11 16:53:15 16:53:19

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Q Inset? 16:53:22
A Inset. It's -- yes, thank you. It's 16:53:23
inset from the wafer edge. Okay. 16:53:25
And one other thing to note, okay, where 16:53:29
there's a continuation of the structure implied, 16:53:33
the boundary line has some symbol; in this case, a 16:53:38
little Z, indicating continuation. So ... 16:53:41
Q If you go to paragraph 27 of Cousins. 16:53:47
A Of Cousins, okay. 16:53:51
"In Figure 4D, the edge isolation trench 16:53:55
is formed"? 16:54:09
Q Yes. 16:54:10
A Yes. Okay. 16:54:11
Q So you acknowledge that Cousins' 16:54:12
paragraph 27 says that the edge isolation trench 16:54:15
is formed near the edge of the substrate 101 on 16:54:18
the backside? 16:54:23
A Near isn't at. Oh, I'm sorry, did you 16:54:24
finish? 16:54:27
Q My first question is, do you acknowledge 16:54:29
that Cousins does say -- does teach to put the 16:54:31
trench, quote, near the edge? 16:54:35

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MR. De BLANK: Objection. Document speaks for itself. 16:54:38 16:54:39

A But not at the edge, which is what -- the teaching of the '104 and '009 patents. 16:54:40 16:54:43

Q Doesn't the claims say "in an edge portion"? 16:54:53 16:54:56

A An edge, an edge portion, right. That would be the edge of the wafer. Yeah, that's how I was interpreting it. And I think that's a reasonable interpretation. And you can see in the figure, the mouse snips right at the end. 16:54:57 16:55:00 16:55:02 16:55:05 16:55:07

Q Would it be reasonable to interpret "edge portion" to mean any portion that's at the edge? 16:55:11 16:55:13 16:55:18

A Not in combination with the figures shown in the patent. It's clear what an edge portion is. We could reserve "portions" to the '10 -- the '104 and '009 patents, yeah, that terminology. 16:55:19 16:55:21 16:55:24 16:55:28 16:55:34

Q Sorry? 16:55:38

A Yeah, we could reserve the terminology "portion" to those two patents I just mentioned. 16:55:39 16:55:41

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Q What do you mean "we could"? 16:55:49
A If you want to use that language, that would be fine. 16:55:50 16:55:52
Q You're talking about "edge portion"? 16:55:57
A Yeah, it pertains to something disclosed in the '104, '009. 16:56:00 16:56:02
Q Couldn't the ordinary usage of the term "portion" mean any portion near the edge? 16:56:07 16:56:09
A Okay. A portion means segment, part of. 16:56:17
Q So couldn't "edge portion" mean any segment at the edge? 16:56:27 16:56:29
A Of the edge. What is the edge? The edge is a terminus. A boundary of the wafer in this case. 16:56:31 16:56:34 16:56:37
Q So the isolation portion needs to start from the absolute boundary? 16:56:40 16:56:43
A It has to include the absolute boundary. Like the mouse snips takes a snip right out of the edge of the wafer. 16:56:46 16:56:48 16:56:53
Q Are you saying the isolation portion has to correspond to the figure? 16:57:00 16:57:03
MR. De BLANK: Objection. Misstates the 16:57:06

testimony. Vague. 16:57:07

A The patent teaches -- teaches how to 16:57:12

make this stuff. It does it in two ways, through 16:57:14

the verbal -- through written text and through the 16:57:19

figures. It's teaching you how to do this not 16:57:23

only through the text but through the figures. 16:57:27

And those figures show the mouse snips at the 16:57:31

junction -- at the wafer edge. 16:57:35

Q In 457 when you say, "A trench formed 16:58:12

through the substrate cannot be in an edge 16:58:15

portion," are you saying -- are you disputing that 16:58:19

Cousins' trench is an isolation portion because it 16:58:27

digs into the substrate? 16:58:30

A No. I'm saying that it's -- it doesn't 16:58:39

conform to the -- to the claims of the accused 16:58:48

patents because it doesn't fall on an edge. 16:58:53

Q Okay. If you go to 451 and 452. 16:58:59

A Okay. In my report? Okay. I'm on 451 16:59:46

now. 17:00:04

Q 452. 17:00:10

A Okay. 17:00:15

Q You're referring to the emitter in the 17:00:16

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n-doped regions and you say: 17:00:20

Because these regions are disposed at 17:00:23

different sides of a substrate, they cannot form a 17:00:26

short circuit, and thus, Cousins has no need for, 17:00:30

and does not disclose, an isolation portion of the 17:00:32

type claimed by the '104 patent. 17:00:36

Did I read that correctly? 17:00:38

A Yes. 17:00:40

Q Is it your opinion that Cousins' Figure 17:00:41

1 is showing its edges? 17:00:43

A It's not -- were you finished? 17:00:49

It's not showing the whole edge by any 17:00:54

stretch of the imagination. 17:00:57

Q So Cousins could very well have 17:01:09

diffusion at its edge? 17:01:12

A It certainly doesn't disclose an 17:01:22

isolation -- really anything like isolation in the 17:01:26

accused patents. Just visual speculation reveal 17:01:29

that. As I said, the -- the -- the trenches 17:01:35

generally inhibit lateral charge motion. That's 17:01:47

what they're designed to do. While in point of 17:01:54

fact, the '10 -- '104 and '009 patents use 17:02:00

trench -- use their isolation portion to be -- to block vertical transport up that contaminated sidewall, or down that contaminated sidewall. So we're talking about different animals here. 17:02:08 17:02:18 17:02:22 17:02:27

If you want to repeat your question, I could try to be more -- 17:02:32 17:02:35

Q You haven't identified any technique in Cousins that would remove dopants from the sidewall? 17:02:37 17:02:41 17:02:44

A I didn't see any. That I recall. 17:02:49

Q And -- 17:03:25

A Yeah -- sorry. 17:03:25

Q Did you -- I was going to ask another question, but -- 17:03:29 17:03:31

A I was going to say -- there's something I -- I remember that I'm looking for, okay? So I'm sorry to take so much time. 17:03:32 17:03:47 17:03:51

Q Are you still looking or should I -- 17:03:55

A No, I'm looking. If I find -- he talks about p- and n-type doping sources, yeah. Okay. 17:03:57 17:04:03

The way he does his doping is he uses either borosilicate glass or phosphosilicate 17:04:26 17:04:32

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glasses, okay, which weigh over -- which, when deposited, would behave like gaseous doping sources because they would coat the edge. 17:04:39 17:04:47 17:04:52

And so what you do is you spin the stuff on, you heat it up, it forms a glass, and it bleeds. If it's a phosphosilicate glass, it will bleed phosphorus into the cell, okay, and dope it. 17:04:55 17:05:02 17:05:09 17:05:14

But you still have the issue of the -- of the emitter doping. Actually, this drawing is upside-down with respect to the other patents. He's got his emitter in the bottom, okay, so the backside field would be up top, okay, but it's still the same thing, okay. 17:05:18 17:05:20 17:05:30 17:05:34 17:05:37 17:05:40

He's got the borosilicate glasses or phosphosilicate glass covering the wafer's edge and forming a contamination bridge. Okay. And that bridge is present even though it's not much material to the right of the -- or to the left of the bridge, of the trench, okay, but it's still contacting. 17:05:41 17:05:46 17:05:49 17:05:57 17:06:04 17:06:07 17:06:16

Yeah, that's what I was looking for, the borosilicate and phosphosilicate glass portions. 17:06:33 17:06:36

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Q If you go to paragraph 172. 17:07:11
A Okay. Paragraph 172 of my report? 17:07:16
Q Yeah, it's quite a bit back. 17:07:21
A What page? 17:07:24
Q It's in your section about Cousins' 17:07:25
combination. 17:07:30
A 172, okay. Here we are. Okay. 17:07:32
To the extent that Banerjee is instead 17:07:59
suggesting Kyeong's laser edge method we used. 17:08:02
That's what you're interested in? 17:08:06
Q I was going to refer you to the second 17:08:08
sentence where you say: 17:08:10
Indeed, Dr. Banerjee acknowledges that 17:08:11
Kyeong itself admits that, quote, laser scribing 17:08:15
will always produce heat-induced defects at the 17:08:19
scribe line, unquote, that will reduce solar cell 17:08:25
efficiency. 17:08:28
Did I read that correctly? 17:08:29
A Yes. 17:08:32
Might I add -- there it is. I mean 17:08:33
here's the -- Cousins himself says that trench -- 17:08:38
trenching does add extreme numbers of defects and 17:08:43

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degrades the quality of the structure. 17:08:49

Q That's kind of where I was going. 17:08:53

So when you say, in your opinion, the technique such as Cousins uses, a POSITA would recognize that it will always form heat-induced defects from the laser -- the heat of the laser? 17:08:55 17:09:05 17:09:10 17:09:14

A Yes. 17:09:18

Q And that those defects will reduce solar cell efficiency? 17:09:23 17:09:27

A Yes. They'll gobble up the charges before they can get out of the device. 17:09:28 17:09:33

Q Would that be a defect to the silicon substrate? 17:09:40 17:09:44

A It would extend along the whole wall of the trench, and you're right, you could get dislocations propagate down into the bulk of the silicon around the trench. In other words, the crystal could crack, form microcracks. 17:09:45 17:09:49 17:09:52 17:09:56 17:09:58

Q And -- 17:10:08

A That's something I would be drawn to do, yeah. 17:10:08 17:10:10

Q When you say it will reduce efficiency, 17:10:18

is that because those defects will become recombination sites? 17:10:20 17:10:24

A Yes. 17:10:26

Q What are you alleging actually happens at the surface that is causing that recombination? 17:11:23 17:11:27

MR. De BLANK: Objection. Vague. 17:11:31

A Well, okay, you're breaking bonds at the surface, you rip the adjacent material out, okay? Those broken bonds form what are called dangling bonds that project outward. Those dangling bonds pick up all kinds of stuff from the environment. 17:11:35 17:11:38 17:11:41 17:11:45 17:11:49

They -- if you attempt -- typically there's a -- there's a more or less complex layer structure in the trench itself, includes nitrides, other oxides, and those are all aimed at compensating for those defects, rendering them electronically inactive. So that's where the complication comes in. 17:11:53 17:11:59 17:12:07 17:12:13 17:12:18 17:12:21 17:12:24

But the idea is, yeah -- think about -- even if you take a diamond scribe and go like that (indicating) just across a wafer, it -- you're breaking all kinds of bonds, and you -- the 17:12:27 17:12:29 17:12:32 17:12:36

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dangling bonds are going to pick up oxygen and other junk. And so that's what you end up with, a defective interface which can conduct charge and could generate electron whole pairs. 17:12:40 17:12:43 17:12:48 17:12:51

Q Your basis of that knowledge is your experience and not necessarily any particular document? 17:13:00 17:13:08 17:13:11

A Well, there is my experience, okay, but look at the document itself, the document says Kyeong teaches that. That, in the absence of any significant proof of improvement in Cousins itself. 17:13:11 17:13:15 17:13:19 17:13:26 17:13:31

Q Would a POSITA recognize that absent Kyeong's teaching? 17:13:41 17:13:45

MR. De BLANK: Objection. Vague. Incomplete hypothetical. 17:13:48 17:13:49

A But I would say a POSITA would know that. You go to meetings, we're always talking about trench -- in that time period, they were always talking about passivating trench isolation. 17:13:50 17:13:52 17:13:55 17:13:57

Q Would you agree that laser isolation trenches such as Cousins' are typically formed 17:14:01 17:14:06

slightly inset from the edge but very near the edge? 17:14:09 17:14:14

A Well, that's what he tries to do, okay. And it's obvious that you would try to do that, okay. But it doesn't remove the fact that he is -- he does have contact between the contaminated sidewall and the underlying n backside field layer. So all of those things would lead to the conclusion that -- that '104 and '009 are distinct and not obvious. 17:14:15 17:14:19 17:14:22 17:14:27 17:14:31 17:14:37 17:14:46 17:14:52

Q Can you go to the paper titled "Laser Edge Isolation for High-Efficiency Crystalline Solar Cells". 17:14:57 17:15:04 17:15:09

A Yeah, that's Kyeong, right? 17:15:12

Q And is that -- does that have an exhibit number on it? 17:15:16 17:15:19

A Yes, it's 17. 17:15:20

Q Okay. Can you look at the bottom of page 125? 17:15:22 17:15:34

A Yes. 17:15:41

Q Right above where it says Shunt Resistance section heading, on the right, the 17:15:44 17:15:47

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sentence right above it, it says: 17:15:53

Figure 4 shows the edge isolated scribe 17:16:01

line made on the front side at a distance of 17:16:07

0.2 millimeters from the edge of the cell. 17:16:09

A I'm not following you. Is that on page 17:16:13

-- what page again? 17:16:17

Q Sorry, did I -- did I tell you the wrong 17:16:23

page? Okay. 17:16:30

It says -- sorry, it says the same 17:16:35

things basically in two places, but right -- the 17:16:38

last sentence of 125 says: 17:16:40

A fiber laser with a wavelength -- 17:16:43

A Yes, I got. 17:16:48

Q -- of 1064 nanometers was used to scribe 17:16:49

a group of 0.2 millimeters inside the perimeter 17:16:52

all around the wafer on either the front or back. 17:16:56

A Yes. 17:17:00

Q And if we turn to 127. On the right 17:17:06

column, about midway down, it -- there's a 17:17:18

sentence that starts with, "Solar cell parameters 17:17:23

increased." 17:17:26

A Yeah, you did a considerable -- are you 17:17:29

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finished with -- 17:17:32

Q It says -- 17:17:35

A No, I've got it. Are you finished? 17:17:35

Q I was just going to read. It says: 17:17:38

The solar cell parameters increased when 17:17:41
the front edge isolation was made at a distance of 17:17:44
0.1 millimeters instead of 0.5 millimeters from 17:17:49
the edge. However, due to the non-uniformity in 17:17:54
the wafer edges, the edge isolation has 17:17:59
0.1 millimeters at times went beyond the boundary 17:18:03
of the wafer. Thus, it was difficult to control 17:18:07
laser isolation within the wafer unless the wafer 17:18:13
had perfect dimensions. Therefore, we suggest 17:18:16
that the best edge isolation line should be 17:18:20
located at a distance of 0.2 millimeters from the 17:18:24
edge of the wafer. 17:18:28

Did I read that correctly? 17:18:29

A Yep. 17:18:31

Q You agree, at least according to this 17:18:33
document, that it would be undesirable and 17:18:37
unrealistic to place the laser scribe exactly at 17:18:43
the edge? 17:18:47

A It would. For reasons he says. It's difficult to control the position of the scribe line. And he also shows exactly what I was mentioning. Considerable experimentation would be needed to effect a manufacturable process or an attractive process in any event. This is hard stuff to do. 17:18:48 17:18:53 17:18:55 17:19:01 17:19:04 17:19:12 17:19:17

Q Are you talking about a commercial implementation? 17:19:21 17:19:23

A Commercial implementation, right. 17:19:24

Q It doesn't -- it seems like he just tried a few different -- 17:19:26 17:19:32

A Yeah. 17:19:34

Q It doesn't seem too difficult of experimentation. 17:19:35 17:19:38

A Well -- 17:19:39

MR. De BLANK: Objection. Vague. Document speaks for itself. 17:19:40 17:19:42

A Right. Yeah, and also, may I note, that if you look at Figure 2, you see what I've indicated. You've got these -- they show up as gray bars extending from the top surface to the -- 17:19:43 17:19:52 17:19:55 17:20:02

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which would be the field -- no, this is p-type sub -- the top surface would be the emitter, the bars stretching around and hitting the bottom contact. Okay. So you see that there is touching there. It hasn't eliminated the contact with the -- with the undesired material. 17:20:06 17:20:11 17:20:15 17:20:19 17:20:27 17:20:36

Q The point about the previous paragraph you read about, the proper distance, would you agree that Cousins' teaching of putting the trench near the edge is typical of where you would put the trench as a POSITA would understand the laser isolation trench? 17:20:45 17:20:47 17:20:52 17:20:56 17:21:02 17:21:07

MR. De BLANK: Objection. Vague. Compound. Incomplete hypothetical. 17:21:08 17:21:09

A If you were up for some pain and you wanted to develop this process, okay, you'd try to put the laser groove as close to the edge as possible, yeah, yep, yep. 17:21:14 17:21:19 17:21:23 17:21:28

Q As close to the edge as possible without hitting the edge and breaking the -- 17:21:30 17:21:34

A The wafer, right. Yes. 17:21:36

Q We might be done; let me just 17:21:58

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doublecheck. 17:22:01

One question. If you turn to page 176? 17:22:01

A Okay, got it. 17:24:49

Q The term a thickness of an edge region in the first conductive-type semiconductor region progressively decreases towards the first isolation portion. 17:24:55 17:25:01 17:25:05 17:25:09

A Yep. 17:25:10

Q The term "progressively decreases" -- 17:25:16

A Yep. 17:25:22

Q -- are you interpreting that as essentially the polysilicon has a non-right angle? 17:25:25 17:25:29

A Right. It gets -- 17:25:43

MR. De BLANK: You have to let him finish. 17:25:44 17:25:45

A Oh, I'm sorry, go on. 17:25:46

Q It has a non-right angle. It doesn't have an abrupt ending at a right angle? 17:25:48 17:25:51

A Right. 17:25:56

Q But would you agree that a laser trench would typically form a rounded profile? 17:25:56 17:25:59

MR. De BLANK: Objection. Vague, 17:26:04

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incomplete hypothetical. 17:26:05

A Yeah, I -- it depends on the conditions 17:26:06

of the laser tool, but it's clear in the mouse 17:26:10

snip in '104 and the '009 patents, okay, that the 17:26:21

backside field layer decreases as its thickness 17:26:28

decreases, maybe parabolically kind of as you move 17:26:34

toward the wafer edge, and that's a good thing, 17:26:38

okay. If you have time, I could explain why, but 17:26:41

I mean -- 17:26:45

Q Would you agree that a laser trench 17:26:48

would never be exactly perfectly square? 17:26:51

MR. De BLANK: Objection. Incomplete 17:26:55

hypothetical. 17:26:56

A It can look square -- it can start 17:26:58

looking square. It depends on the -- what the 17:27:02

laser energy is, what the wavelength of the laser 17:27:04

is, what -- the absorption of the material, a 17:27:08

whole bunch of stuff, okay? It can look kind of 17:27:11

square. 17:27:15

Q If it was a gallcium [sic] beam, would 17:27:16

you acknowledge it would not be square? 17:27:20

A No, it'd still be square. I mean to my 17:27:22

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knowledge. I've seen laser scribes and what all. 17:27:25
I -- admittedly, I didn't take this to the 17:27:30
scanning microscopes, but I've looked at them 17:27:33
under optical microscopes and they look pretty 17:27:37
square. I didn't see any noticeable rounding as 17:27:40
we see in the mouse snip structure. 17:27:49
Q But they wouldn't be perfectly square; 17:27:59
you'd agree with that? 17:28:01
MR. De BLANK: Objection. Vague, 17:28:04
incomplete hypothetical. 17:28:05
A It wouldn't be perfectly square. It's 17:28:08
square-like. 17:28:14
Q Last question is if you go to page 142. 17:28:19
A 142, okay. Got it. 17:28:32
Q Similarly, would the laser trench -- 17:28:38
would you agree the shadow mask will always at 17:28:42
least have some tapering? 17:28:50
MR. De BLANK: Objection. Vague, 17:28:54
incomplete hypothetical. 17:28:55
A You see, that's the problem especially 17:28:59
with this kind of a laser mask. Shadow mask. 17:29:02
Okay. You got -- these masks call for a big 17:29:08

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square cutout of a metal disk, basically, and those are -- think about it. They're prone to deformation. And when they sit on the -- when they sit over the wafer, you're going to have varying degrees of separation. 17:29:14 17:29:17 17:29:21 17:29:26 17:29:30

If you had perfect contact, you would have no -- the -- Banerjee calls it underspray, overspray. I think most people call it undercut. The deposit material undercuts the mask itself. 17:29:31 17:29:36 17:29:42 17:29:46

And so what you end up with is variations of mask-to-wafer thickness, and you get different -- you end up with a jagged line. 17:29:53 17:29:56 17:30:00

Q But you would never have, quote/unquote, perfect contact? 17:30:06 17:30:07

A And you'd probably never have -- 17:30:09

Q Let -- 17:30:12

A I apologize. 17:30:12

MR. De BLANK: Had you finished your question or ... 17:30:16 17:30:17

MR. ROTHENBERG: Yeah. 17:30:17

MR. De BLANK: Objection. Vague, incomplete hypothetical. 17:30:17 17:30:19

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A Okay. All right. It wouldn't -- you'd always get a little bit of undercut there, yeah. 17:30:21 17:30:26

Q Or overspray? 17:30:29

A Or overspray. 17:30:31

But the -- the other issue really is alignment, you know, the alignment in micro-electronics is nanometric. Okay. But here, I mean you're mechanically moving around this deformed plate, so you got alignment issues. 17:30:32 17:30:35 17:30:39 17:30:44 17:30:49

Q Okay. 17:30:55

MR. ROTHENBERG: No further questions. 17:30:55

THE WITNESS: Super. Thank you. 17:30:59

MS. SLADIC: I might actually have a few very brief questions, but can we take a quick break? 17:31:01 17:31:04 17:31:07

MR. ROTHENBERG: Pass the witness. 17:31:10

THE VIDEOGRAPHER: We are going off the record. The time is 5:31 p.m. 17:31:10 17:31:11

(A recess was taken.) 17:31:13

THE VIDEOGRAPHER: We are back on the record. The time is 5:37 p.m. 17:37:04 17:37:05

17:37:07

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EXAMINATION BY COUNSEL FOR THE ITC -
OFFICE OF UNFAIR IMPORT INVESTIGATIONS

BY MS. SLADIC:

Q Good evening, Doctor. I don't think we have formally met on the record, so my name is Sarah Sladic. I'm with an office within the United States International Trade Commission. I'm not affiliated with Respondents. I'm not affiliated with Complainants, and I'm trying to learn a little bit more about solar cells. 17:37:09 17:37:12 17:37:15 17:37:19 17:37:21 17:37:23 17:37:26

A As are we all. 17:37:28

Q I have some questions, and I'm going to apologize in advance, because they were developed as I was listening along with you today, so I might jump around a little bit. 17:37:31 17:37:34 17:37:37 17:37:40

But if we could start by turning to page 12 of Exhibit 1, which is your report. 17:37:41 17:37:46

A Okay. Which -- 17:37:53

Q Page 12, please. 17:37:55

A Yes. 17:38:05

Q Okay. In paragraph 44 on page 12 you 17:38:05

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state:
Where I do not affirmatively discuss applying a proposed construction, and for all other terms, I have applied the plain and ordinary meaning as it would have been understood by a POSITA at the time of the inventions of the asserted patents.
Do you see that?
A Yes, I do.
Q For the times throughout your report where you do not specifically mention applying a construction of the term "isolation portion," am I to understand from paragraph 44 that you were applying a plain and ordinary meaning of the term "isolation portion"?
A Yes. I was restricting it, yes.
Q So is it your opinion that a POSITA at the time of the invention of the asserted patents would have an understanding that "isolation portion" has a plain and ordinary meaning?
A Yes.
Q And I may want to ask you some questions

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about the asserted patents which are Exhibits 2 and 3, if you want to grab those. 17:39:27 17:39:31

A Got them. 17:39:33

Q And I think you agreed with Respondents' counsel earlier in the day that generally the description in the Specification is roughly the same between the two asserted patents; is that correct? 17:39:38 17:39:40 17:39:46 17:39:49 17:39:51

A Oh, yes, yes. 17:39:52

Q So I'm, for convenience, going to be referring to the '104 patent. If you could turn to Figure 3. 17:39:54 17:39:57 17:40:04

A (Complying.) 17:40:08

Q And that's Figure 3 of the '104 patent which is Exhibit 2, for the record. 17:40:08 17:40:24

A Yes. 17:40:25

Q Do you recall being asked some questions earlier in the day about Figure 3 of the asserted patents? 17:40:26 17:40:27 17:40:32

A Yes. Yes, largely to clarify the meanings of the dimension D1 and the structure I. 17:40:33 17:40:41

Q Is it your understanding that Figure 3 17:40:48

depicts an embodiment of the invention and particularly the backside of the substrate of an embodiment of the invention? 17:40:53 17:40:57 17:41:00

A As I recall, that is the case. 17:41:01

Q And in that embodiment, or at least the embodiment depicted in Figure 3, the isolation portion represented by an I extends along all of the edges of the backside of the substrate; is that correct? 17:41:09 17:41:11 17:41:15 17:41:22 17:41:28

A Exactly. That's the point I tried to make over and over again. 17:41:29 17:41:31

Q If you could turn to column 2 of the '104 patent, which is Exhibit 2. 17:41:42 17:41:44

A Uh-humh. Okay, which line? 17:41:48

Q Okay. And I would like to focus our attention beginning -- the paragraph beginning around line 24 in column 2. 17:42:01 17:42:05 17:42:07

A Yeah. "For example, the isolation," yes. 17:42:10 17:42:13

Q Beginning at line 24, column 2 states: 17:42:15

For example, the isolation portion may exclude the tunnel layer and the first 17:42:17 17:42:21

conductive-type semiconductor region and may be in the edge portion of any one of the first surface side and second surface of the semiconductor substrate. 17:42:23 17:42:27 17:42:31 17:42:35

Do you see that? 17:42:35

A Yes. Yeah. 17:42:36

Q Did I read that correctly? 17:42:37

A Yes, you did. 17:42:39

Q Okay. And then if we could turn to column 13 of the '104 patent. 17:42:40 17:42:53

A Okay. Column 13. Okay. 17:42:58

Q Okay. Are you there? 17:43:18

A Yes. 17:43:19

Q Okay. And I would like to focus our attention beginning around line 16 -- 17:43:19 17:43:22

A Okay. 17:43:25

Q -- of column 13. 17:43:26

A Yep. 17:43:28

Q Line 16 states, or begins: 17:43:29

The isolation portion I may block a contact between the first conductive-type semiconductor region 170 and the second conductive 17:43:32 17:43:36 17:43:38

type semiconductor 120, and any one of the first surface side and second surface of the semiconductor substrate 100. 17:43:42 17:43:47 17:43:51

Do you see that? 17:43:54

A Yes, I do. 17:43:55

Q Did I read that correctly? 17:43:56

A Yes, you did. 17:43:58

Q Based on those two disclosures of the '104 patent and the '009 patent as we discussed which has a similar disclosure, do you have any opinion with regard to whether or not the embodiment we looked at in Figure 3 depicts the only location for an isolation portion disclosed in the patent? 17:43:59 17:44:03 17:44:09 17:44:13 17:44:17 17:44:21 17:44:24

A Well, there are certainly salient points. I mean it has to appear at the edge. At the edge, okay, not -- not displaced from the edge, okay? That was one thing. 17:44:27 17:44:29 17:44:33 17:44:37

Can isolations appear elsewhere? Yes. But they wouldn't be as effective. Because they would impinge on the active area of the cell. It would reduce the sensitive volume, so to speak. 17:44:38 17:44:46 17:44:51 17:45:10

Q I understand it's your opinion that it -- the isolation portion must appear in the edge. Do you have an opinion based on the disclosures we just looked at if the backside of the substrate must contain the entirety of the isolation portion? 17:45:15 17:45:17 17:45:20 17:45:26 17:45:30 17:45:34

A No, it extends -- how far -- I believe the patent is silent on the issue of the physical dimension. I mean except for the -- the -- where the -- where the isolation terminates, it talks about the distance D, and then we also talk about L -- I, which clearly identifies the isolation region itself, okay? 17:45:35 17:45:44 17:45:48 17:45:54 17:45:58 17:46:01 17:46:06

But can the mouse snip extend up? It doesn't tell you where the mouse snip ends. It probably isn't -- you'd like it to be as small a structure as possible. That's -- would be my take on it. 17:46:08 17:46:15 17:46:18 17:46:23 17:46:27

Q Do you have an opinion whether or not an isolation portion can appear at -- can be located in an edge portion of the backside -- 17:46:35 17:46:39 17:46:46

A Yes. 17:46:49

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Q -- of the surface but also extend over to the side surface of the substrate? 17:46:50 17:46:52

A Well, I mean it does. I mean if I can call your attention to Figures 2, okay, you can see the mouse snip is extending up, it's remove -- it's bitten out the edge portion on the lower left and lower right, and it's creeping up toward -- toward the surface, toward the top side along the sidewall of the wafer. 17:46:59 17:47:01 17:47:07 17:47:15 17:47:20 17:47:24 17:47:34

MS. SLADIC: The Staff has no further questions at this time. 17:47:39 17:47:40

MR. De BLANK: Thank you. 17:47:41

I have no questions, thank you. 17:47:41

MR. ROTHENBERG: I have one Redirect question. 17:47:44 17:47:46

FURTHER EXAMINATION BY COUNSEL FOR THE RESPONDENTS ADANI SOLAR USA, INC., AND MUNDRA SOLAR PV LIMITED 17:47:46 17:47:46

BY MR. ROTHENBERG: 17:48:02

Q You were asked -- you were just asked if you're applying the plain and ordinary meaning of the term "isolation portion," and you said, "I was restricting it." What do you mean by you were 17:48:20 17:48:25 17:48:27 17:48:30

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restricting it? 17:48:34

A I was restricting that particular 17:48:35

two-word combination to the reference associated 17:48:37

with the '104, '009 patents, because that was the 17:48:43

only patent where the term "portion" was 17:48:48

mentioned. And so that easily identified what I 17:48:53

was referring to. I was referring to the 17:48:57

structure that appeared in '104 or '009. That was 17:49:00

the restriction. But in general -- but the plain 17:49:04

and ordinary -- their definition of "portion" is a 17:49:09

segment, as a part, still holds in my definition. 17:49:12

Q When you say you were restricting it to 17:49:20

the reference associated with the '104 and '009 17:49:24

patents, are you saying you're restricting it to I 17:49:27

as shown in the figures of the '104 and the '009 17:49:33

patents? 17:49:36

A When -- 17:49:37

MR. De BLANK: Objection. Vague. 17:49:37

Misstates the testimony. 17:49:39

A I would say I -- insofar as -- that's -- 17:49:43

I mean there was another I in other of the 17:49:45

patents, okay? All I'm doing is trying to say 17:49:49

that to label a specific set of processes to a specific product and talk about how that product either does or does not appear obvious in light of other issues. 17:49:52 17:49:58 17:50:06 17:50:12

I just wanted to label the -- I wanted to label what I was talking about more precisely so you would know when I talk about a portion I'm talking about the drawings that appear in the '104, '009 patents. 17:50:14 17:50:18 17:50:22 17:50:24 17:50:26

MR. ROTHENBERG: No further questions. 17:50:30

MR. De BLANK: No questions. 17:50:33

THE VIDEOGRAPHER: We are going off the record. The time is 5:50 p.m. 17:50:36 17:50:37

(Off the record at 5:50 p.m.) 17:50:40

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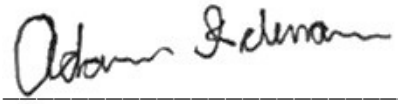
CERTIFICATE OF NOTARY PUBLIC

I, Adam Schuman, the officer before whom the witness was sworn, do hereby certify that the witness was sworn/affirmed to tell the truth, the whole truth and nothing but the truth; and that I am neither counsel for, related to, nor employed by any of the parties to this case and have no interest, financial or otherwise, in its outcome.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 1st day of August, 2025.

My commission expires:

June 14, 2026



_____

NOTARY IN AND FOR THE

DISTRICT OF COLUMBIA

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ACKNOWLEDGMENT OF DEPONENT

I, Martin Peckerar, Ph.D., do hereby acknowledge that I have read and examined the foregoing testimony, and the same is a true, correct and complete transcription of the testimony given by me, and any corrections appear on the attached Errata sheet signed by me.

_____ _____

(DATE) (SIGNATURE)

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CERTIFICATE OF SHORTHAND REPORTER

I, Dawn M. Hart, the officer before whom the foregoing deposition was taken, do hereby certify that the foregoing transcript is a true and correct record of the testimony given; that said testimony was taken by me stenographically and thereafter reduced to typewriting under my direction; that reading and signing was not discussed; and that I am neither counsel for, related to, nor employed by any of the parties to this case and have no interest, financial or otherwise, in its outcome.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 5th day of August, 2025.

My commission expires:

January 2, 2029



_____

NOTARY IN AND FOR THE

STATE OF MARYLAND

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