

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

|                         |   |               |
|-------------------------|---|---------------|
| BOE TECHNOLOGY GROUP    | : | IPR2024-01132 |
| CO., LTD.,              | : | and           |
|                         | : | IPR2024-01315 |
| Petitioner,             | : |               |
|                         | : |               |
| v.                      | : |               |
|                         | : |               |
| OPTRONIC SCIENCES, LLC, | : |               |
|                         | : |               |
| Patent Owner.           | : |               |
| _____                   | : |               |

VIDEOTAPED DEPOSITION OF  
DEAN NEIKIRK, PH.D.  
CONDUCTED REMOTELY  
Thursday, April 17, 2025  
10:02 a.m. Central Time

Job No.: 110991

Stenographically Reported By:  
Theresa Williamson, RPR, RMR, CRR, CA CSR No. 14545

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1 (All appearing via video conference.)

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19  
20  
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22  
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24  
25

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TRANSCRIPT MARKED AT THE REQUEST OF COUNSEL

(None.)

\* \* \* \* \*

QUESTIONS WITNESS INSTRUCTED NOT TO ANSWER

(None.)

1 P R O C E E D I N G S

2 THE VIDEOGRAPHER: Okay. Good morning. We  
3 are now on the record. This is the beginning of  
4 Media Number 1 in the deposition of Dr. Dean Neikirk  
5 in the matter of BOE Technology Group Co., Ltd.,  
6 versus Optronics Sciences, LLC. The case number is  
7 IPR2024-01132 and 01315.

8 This deposition is being held remotely as a  
9 Zoom conference and being taken on behalf of  
10 defendants on April 17, 2025, at 10:02 a.m. Central  
11 time.

12 The court reporter is Terry Williamson. I am  
13 Mariel Mercado, the videographer, on behalf of First  
14 Legal Depositions located in Los Angeles, California.

15 This deposition is being videotaped at all  
16 times unless specified to go off the video record.

17 Would all present please identify themselves,  
18 beginning with the noticing attorney.

19 MR. CUMMINGS: This is Jefferson Cummings  
20 with Russ August & Kabat representing patent owner.  
21 With me is my colleague Peter Tong.

22 THE VIDEOGRAPHER: Mr. Loney, I'm not sure if  
23 you're speaking, but I can't hear you.

24 MR. LONEY: Can you hear me now?

25 THE VIDEOGRAPHER: Yes.

1 MR. LONEY: I'll just switch mikes.

2 Zachary Loney, with DLA Piper, on behalf of  
3 petitioner, BOE Technology Group, and the witness.  
4 With me are my colleagues Peiyao Zhang and Brian  
5 Erickson.

6 THE VIDEOGRAPHER: Okay. Thank you. Now the  
7 court reporter has a read-on and then she will swear  
8 in the witness.

9 THE STENOGRAPHER: Good morning. My name is  
10 Theresa Williamson, and my California CSR number is  
11 14545.

12 (Whereupon, the deponent was duly sworn.)

13 EXAMINATION

14 BY MR. CUMMINGS:

15 Q Mr. Neikirk, you understand that this is a  
16 deposition in which I will ask you questions and you  
17 must answer them truthfully?

18 A I do.

19 Q And your attorney may object from time to  
20 time, but you must still answer the question unless  
21 your attorney tells you clearly and directly not to  
22 answer. Do you understand?

23 A I do.

24 Q Although no judge is present, this is a  
25 formal legal proceeding, just like testifying in

1 court, and you are under the same legal obligation to  
2 tell the truth, the whole truth and nothing but the  
3 truth. Do you understand?

4 **A I do.**

5 Q If you do not understand any of my questions,  
6 let me know, and I will rephrase it. Do you  
7 understand?

8 **A I do.**

9 Q We will take a break from time to time.  
10 Usually every hour or so. You may ask for a break  
11 but not during the middle of a question. We'll need  
12 to finish the question before we take a break. Do  
13 you understand?

14 **A Yes, I do.**

15 Q And please answer my questions audibly and  
16 after I have finished speaking, for the court  
17 reporter. Do you understand?

18 **A Yes, I do.**

19 Q Are you on any drugs or medication that may  
20 affect your memory today?

21 **A No, I am not.**

22 Q Is there any other reason why you can't  
23 provide truthful testimony?

24 **A No, there is not.**

25 Q Before we begin, since we're all doing this

1 remotely today and I can't see anything that's in  
2 front of you, can you let me know if you have any  
3 documents open in front of you?

4 A I have a clean paper copy of the two  
5 declarations that are -- that I've submitted in these  
6 two IPRs, along with clean paper copies of the two  
7 patents at issue.

8 I have no other paper documents in front of  
9 me. All the windows on my computer are closed, other  
10 than this Zoom window.

11 Q Thank you. You've been deposed before;  
12 correct?

13 A Yes, it is -- that is correct.

14 Q How many times?

15 A I don't keep count, but I'm sure it is well  
16 over 50 times.

17 Q Is there anybody in the room with you?

18 A No, there is not.

19 Q How many IPR proceedings have you been a part  
20 of?

21 A I have not counted those, but I'm -- I would  
22 guess it's in -- around 20 or perhaps a few more than  
23 that.

24 Q BOE retained you in this matter; is that  
25 correct?

1           A    Yes.

2           Q    When were you retained?

3           A    I didn't go back and check my records, so I  
4 don't recall precisely. I think it was on the order  
5 of six to nine months ago, I -- I think.

6           Q    Now, I know you have a paper copy in front of  
7 you, but I'm going to introduce as Exhibit 1001 --  
8 actually, that may get confusing. Sorry. Strike  
9 that.

10                   Exhibit 1. This is your declaration for the  
11 '121 patent which is IPR2024-01132.

12           A    And will a link appear in the chat window for  
13 that?

14                   I'm sorry. I see it now. Excuse me. And  
15 I'll open that document to make sure it opens. Give  
16 me a moment. It's prompting. Save. So let me save  
17 that, and then I'll open it.

18                   If you'll give me a moment, it is giving me a  
19 "Document Not Found" error, so let me try to figure  
20 out what's going on.

21                   Sorry. It still is not opening. Give me one  
22 moment to try to -- ah.

23                   Okay. Sorry. Now it -- now it has opened,  
24 and I see the document labeled as Exhibit 1002. It  
25 -- let me scan through it.

1           And it certainly does appear to be a copy of  
2 my declaration for the '121 patent.

3           Q   How long did you spend working on this  
4 report?

5           A   Well, I think I have a rough idea of total  
6 hours I've spent so far on these three patents, and  
7 it's in excess of 50 hours I believe. I didn't  
8 really break it out by patent. So I -- I would guess  
9 15, 20 hours, something like that for this one.

10          Q   Did you draft your own report?

11          A   I did not type every word of this. Certainly  
12 I was, from the outset, involved in extensive  
13 discussions about the patent, about prior art. I  
14 made clear what my opinions were.

15                I did have help drafting and writing the  
16 actual type -- getting the actual text in, annotating  
17 figures; but in all cases, I have -- I have reviewed  
18 the documents, revised them to make sure they  
19 accurately reflected my own opinions.

20          Q   Which documents did you review first?

21          A   Well, I would have started with the patent  
22 itself, so the '121 patent and various pieces of  
23 prior art or what I think I've called -- referred to  
24 as background art.

25          Q   Did you find the background art yourself or

1 was it provided to you?

2 A I -- I suspect it was a mix. Some of the  
3 background art, I suspect I found.

4 We would have -- I would have discussions as  
5 to where I believed information would have been known  
6 to one of ordinary skill; and then in conjunction  
7 with that, there might have been a -- I would have  
8 expressed an opinion that it would be useful to have  
9 other art that simply reflected what one of ordinary  
10 skill would -- would, in my opinion, know.

11 Q Did you find any of the references that were  
12 applied in your grounds or were those provided to  
13 you?

14 A My recollection is that the references had  
15 already been identified.

16 Q Have you read the IPR petition?

17 A The petition itself, I'm not sure that I  
18 have.

19 Q Have you read the institution decision?

20 A I don't believe I have reviewed the  
21 institution decision either.

22 Q Did you do anything to prepare for the  
23 deposition today?

24 A I did.

25 Q What did you do?

1           A    I reviewed the patents. I reviewed the art  
2   that I have cited in my declaration. I reviewed my  
3   declaration. I did meet with counsel to discuss  
4   those documents.

5           Q    About how long did you spend preparing for  
6   your deposition today?

7           A    Again, I have not separated this out by  
8   patent; but I've worked on this, for the three, about  
9   two days. About 16, 18 hours total.

10          Q    All right. I'd like to take a look at your  
11   declaration now. Let's start at paragraph 5, with  
12   your background and qualifications.

13                Looking through now at paragraph 8, I see you  
14   describe experience working with optical systems; is  
15   that correct?

16          A    Yes, it is correct.

17          Q    What sort of optical systems did you work  
18   with?

19          A    I have worked with -- with many optical  
20   systems over the last, I guess, 40-plus years now. I  
21   did a lot of what's called optical spectroscopy early  
22   in my education, which involved many different types  
23   of optical measurement equipment, equipment for  
24   producing light, samples for -- examining samples  
25   using light.

1 I continued to work on optoelectronics  
2 systems that operated over a very wide range of  
3 wavelengths. Most of my work was done in what's  
4 called the far infrared to infrared. Some of my work  
5 did involve optical, visible wavelengths, as well.

6 I worked with optically-controlled microwave  
7 devices, a number of optical sensors.

8 Also, I did some work with light emitters or  
9 materials designed to emit light.

10 Q Did any of that experience relate to  
11 manufacturing LEDs or OLEDs?

12 A Much of that related to the design and  
13 manufacture of LEDs. I did a great deal of work on  
14 so-called compound semiconductors which are used for  
15 LEDs.

16 I have been on Ph.D. committees for a  
17 colleague whose specialty was organic layers for --  
18 for organic light-emitting diodes.

19 I personally did not work on the organic  
20 materials. Again, I'm quite familiar with them and  
21 have been on Ph.D. committees of students who were  
22 working in that area.

23 Q Is the -- is the design of LEDs different  
24 from the implementation of LEDs in a circuit? The  
25 physical design.

1           A    I -- I'm not exactly sure I -- I understand  
2   what you mean; but generally, when I use the phrase  
3   "design," I'm talking about the structure used to  
4   build the LED, and I have built many LEDs personally.

5           Those structures, which are inherently tied  
6   to how they are made, when you talk about an  
7   electrical -- overall electrical circuit, you  
8   frequently abstract that as an electrical schematic  
9   and do some of your electrical design in a schematic  
10  fashion, at which point you have represented the  
11  electrical characteristics of the LED in some fashion  
12  appropriate for that schematic design.

13          Q    So would all electrical engineers have a  
14  knowledge of semiconductor fabrication?

15          A    Well, certainly in -- the electrical  
16  engineers in my department, my electrical and  
17  computer engineering at the University of Texas, that  
18  is a require -- was a required course, the  
19  fabrication of the devices.

20               One of the -- the device physics course --  
21  semiconductor-device physics course that all our  
22  students are required to take, I also presented or  
23  taught some of the basics of how those devices are  
24  fabricated.

25          Q    And you said "was." So that no longer is a

1 requirement?

2 A Well, I retired in 20 -- the beginning of  
3 2021, and I haven't checked recently for the overall  
4 requirements.

5 When I retired, I believe that our device  
6 physics course was still required for all of our  
7 electrical engineering students.

8 Our fabrication course, which is a separate  
9 course that I used to teach myself, was required for  
10 all of our students whose specialty, as an  
11 undergraduate, was in the semiconductor area.

12 Q Is that generally a required course in  
13 electrical engineering curriculums, or is that unique  
14 to the university you were at?

15 A It's certainly not unique to the University  
16 of Texas at Austin. I believe that sort of  
17 requirement was quite common amongst schools like  
18 University of Illinois, UC Berkeley, UCLA.

19 I'm trying to think of the ones where I knew  
20 people and had some specific familiarity with their  
21 curriculum. Michigan, Wisconsin.

22 Broadly speaking, I think most of the top 15  
23 EE programs had requirements similar to that.

24 Q I see also in paragraph 8 of your  
25 declaration, you talk about IC fabrication. Is that

1 integrated circuits?

2 A Yes. IC stands for integrated circuits.

3 Q What sort of integrated circuits did you  
4 fabricate?

5 A Well, most of my -- my research group's work  
6 was done in compound semiconductor devices and  
7 integrated circuits.

8 My teaching was specifically focused more on  
9 silicon-integrated circuits, so all sorts: Digital,  
10 analog, the scales of different levels of integration  
11 starting in the old days with VLSI and then  
12 transitioning into ULSI dimensions, ranging from  
13 multiple microns, down to about 100 nanometers over  
14 the years.

15 Q Did any of that include the patented  
16 technology at issue here?

17 A Well, by "patented technology," if you're  
18 referring to the multi -- if you are referring to the  
19 '121 patent, which concentrates on layers and their  
20 arrangements relative to one another to form  
21 components like capacitors, well, yes, certainly,  
22 those topics were covered.

23 Q When was your relevant experience? What time  
24 period?

25 A Well, I -- I mean, I -- I started doing this

1 work in 1981, and so -- and continued that until my  
2 retirement in 2021. So over the course of about -- I  
3 guess that's 30 years.

4 Q And is your IC experience the closest to the  
5 subject matter of the '121 and '477 patents?

6 A Well, I -- I'd certainly say that experience  
7 is very relevant. I don't know whether -- I'm just  
8 looking at the claims of the '121 very quickly.

9 Given the elements of the claims, I'd say  
10 that work on the design and fabrication of  
11 interconnects, electrodes, their use in electrical  
12 circuits, all that's very relevant. So certainly,  
13 broadly, the IC design and IC fabrication would be  
14 extremely relevant.

15 Q Can you explain to me what an electrode is?

16 A An electrode is a word that is used broadly  
17 to refer to a portion, an object, in many cases a  
18 specific object, that's used as part of an electrical  
19 device.

20 It's rarely, standing by itself, forming a  
21 complete component; but it's part of an electrical  
22 component.

23 Q What do you mean "part of an electrical  
24 component"?

25 A Well, for instance, a MOSFET has four

1 electrical connections to the outside world, if you  
2 will: A substrate, a source, a gate and a drain.  
3 And the connections to the outside world, in many  
4 cases, are referred to as electrodes.

5 Now, as is usually the case, the meaning of  
6 the word is context-sensitive; but broadly speaking,  
7 the connection and, in some cases, people would call  
8 the source itself, the physical source, an electrode  
9 of the MOSFET. Similarly, gate, drain and substrate.

10 Q Is an interconnect an electrode?

11 A It could be. An interconnect is usually  
12 something that people talk about as, if you will,  
13 wiring that's used to connect different components or  
14 portions of components together in an integrated  
15 circuit.

16 So usually when I use, and I think people  
17 generally use, the phrase "interconnect," they are  
18 singling out something that's used to wire together,  
19 if you will, other things; but in some instances,  
20 people call those electrodes, as well. They  
21 certainly are usually connected to electrodes.

22 Q So there is some distinguishment between an  
23 electrode and an interconnect? For example, an  
24 interconnect could connect to an anode? And the  
25 anode would be an electrode?

1 MR. LONEY: Objection. Form.

2 THE DEPONENT: Well, so "interconnect" is,  
3 I'd say, in many cases -- again, it's  
4 context-sensitive; but in many cases, it's probably  
5 somewhat narrower than "electrode," but it might very  
6 well refer to the wiring connected to an electrode, a  
7 part of a component. In something that has a cathode  
8 and an anode, you might well have a wire connected to  
9 one or both of those, and those might be referred to  
10 as interconnects.

11 BY MR. CUMMINGS:

12 Q So to clarify my understanding, an electrode  
13 -- an anode would be an electrode?

14 MR. LONEY: Objection. Form.

15 THE DEPONENT: In some contexts, what is  
16 identified as an anode might also be referred to as  
17 an electrode. I would agree with that.

18 BY MR. CUMMINGS:

19 Q What about a bus line? Is that an electrode?

20 A Again, it depends on the context. I've seen  
21 "electrode" used very broadly. I've seen it used in  
22 a very narrow fashion. Depending on the context, it  
23 might be.

24 A bus line is something that I would put  
25 generally in the class of an interconnect.

1 Q And generally, in the art, as an expert,  
2 would it be an electrode?

3 MR. LONEY: Objection to form.

4 THE DEPONENT: I could -- I couldn't answer  
5 that in general. It depends on the specific context.  
6 Again, I think I just explained: I have seen the  
7 word "electrode" used to describe very specific and  
8 narrow structures. I have also seen it used to  
9 describe a very wide range of structures and used  
10 very broadly. So it's -- it's certainly  
11 context-sensitive.

12 BY MR. CUMMINGS:

13 Q What context would cause this to go one way  
14 or another?

15 MR. LONEY: Objection. Form.

16 THE DEPONENT: You know, I -- I have read  
17 patents where an electrode was clearly used in both  
18 the specification and the -- the claims, to refer to  
19 a very specific shape and location of a metal  
20 structure, for instance.

21 I've seen other cases where it referred to  
22 everything connected to a battery. So, you know, an  
23 entire conductive path connected to a battery. It's  
24 very context-sensitive.

25 BY MR. CUMMINGS:

1           Q    Are there any contexts, outside of the  
2    teachings of the patent, that would impact your  
3    understanding?

4           A    I think you find the same thing in textbooks,  
5    for instance. You know, you -- the context in which  
6    the word is used would explain to a reader in a book,  
7    a textbook, what the reference was to.

8                   In a -- an electroplating solution, the two  
9    -- the two things that are dipped into a liquid  
10   electroplating solution are frequently referred to as  
11   electrodes. That description would -- someone who  
12   was trying to learn about electroplating would  
13   understand what was meant by the context, in that  
14   context.

15          Q    All right. I'd like to move on now. I guess  
16   referring back to paragraph 8, it seems like you have  
17   a lot of experience in the semiconductor fabrication  
18   realm. Is that fair to say?

19          A    Yes, it is.

20          Q    In your opinion, would someone, who has  
21   experience taking pre-packaged LEDs and using them in  
22   a circuit, be less qualified than someone like  
23   yourself who has experience with the actual  
24   fabrication of the LEDs?

25          A    I don't know that I would necessarily

1 characterize it as less experience. It might be  
2 different experience.

3 Q In the context of LED manufacture or  
4 fabrication?

5 A Well, if the person has never done anything  
6 but place a packet -- pre -- already completed and  
7 packaged LED into an electrical circuit and use it in  
8 that fashion, they might well not know anything about  
9 how it was built inside that, nor would they need to.

10 Q Would they be qualified as a person of  
11 ordinary skill in the context of this patent?

12 A Well, I believe in -- I believe in my report  
13 I have explained what I believe -- what, in my  
14 opinion, is the level of ordinary skill.

15 That's on -- in this document, it is  
16 paragraph 23 on page 14, where I have stated that it  
17 would be someone with a Bachelor's degree in  
18 electrical engineering or a comparable field of  
19 study, two to three years of professional experience  
20 with electronic and optoelectronic device design, and  
21 then pointing out that additional education can  
22 substitute for professional experience and, if you  
23 will, vice versa.

24 In order to do device design, you need to  
25 understand how devices are built.

1           This -- I did point to experience with  
2   electronic and optoelectronic device design. That's  
3   more than just saying they have knowledge of circuit  
4   design.

5           Q   That's what I'm asking. Would the mere use  
6   of pre-packaged LEDs qualify as the needed  
7   experience?

8           A   I don't think that would meet my -- what is,  
9   my opinion, would be one of ordinary skill. You  
10   wouldn't know what was inside the package.

11          Q   So is your definition of optoelectronic  
12   device design specific to the fabrication of the  
13   package?

14          A   Not necessarily the package, although the  
15   package would be one part of it. It would also  
16   include understanding the layers used inside the  
17   materials, the stack-ups, how those are used to  
18   design a device. It's a physical design, not just --  
19   just an electrical look-up table.

20          Q   Is there anything else encompassed by the  
21   term "optoelectronics"?

22          A   Well, that term, standing on its own, broadly  
23   refers to electronic systems that have some aspect  
24   involving light. I think that's what optoelectronics  
25   means.

1 Q So designing a flashlight would qualify under  
2 the term "optoelectronics"?

3 A In its broadest sense, yes. Many flashlights  
4 today use LEDs and have driver circuits and voltage  
5 regulators. Ultimately, it's about emitting light,  
6 controlling its brightness. If that's the kind of  
7 flashlight you want, that's an optoelectronics  
8 system -- system design.

9 Q You emphasized "system" there. Can you  
10 describe the difference between "system" and "device  
11 design"?

12 A Well, in a flash -- you used the example of a  
13 flashlight. The design of the LED is a device  
14 design. The design of -- let's say it had a  
15 regulator in it used to power MOSFET. The design of  
16 the MOSFET is a device design.

17 The flashlight viewed as a combination of  
18 pre-packaged components: Batteries, LEDs, say, an  
19 integrated circuit, can be done as a system-level  
20 design, where each of those components is simply  
21 represented as a black box with certain terminal  
22 electrical characteristics; but that's not what I was  
23 referring to here. I said "device design."

24 Q For the technology here, wouldn't some  
25 experience with displays or LEDs be needed?

1           A    Well, for this particular patent, inasmuch as  
2   it discusses the layers used for an  
3   electroluminescent device, the -- having experience  
4   with optoelectronic device design, as I've stated in  
5   my opinion as to what would constitute one of  
6   ordinary skill, yes, that would be required.

7           Q    And just to be clear, LED device design  
8   refers to the fabrication of the LED itself?

9           A    That's part of it. I mean, a device design  
10   is, with some desired output -- for an LED, it would  
11   be light of, for instance, a particular color, at a  
12   particular brightness or luminance, power  
13   consumption, all of those things, coupled to the  
14   selection of materials and any appropriate -- I'll  
15   refer to it as stack-up, arrangement of various  
16   layers, sizes, geometries, their orientations  
17   relative to one another, all of that would be  
18   involved in that design.

19          Q    So in order to properly design it, would a  
20   person of ordinary skill need an understanding of  
21   displays?

22               MR. LONEY: Objection. Form.

23               THE DEPONENT: Well, if -- if the application  
24   was for displays, that would be useful. Again, I  
25   said a device with a certain luminance, power

1 consumption, thermal characteristics. Well, that can  
2 be different in the display than a single device.

3 But generally, you have to understand how the  
4 layer selections, their arrangements, their sizing,  
5 how that influences the performance of each device.  
6 In a -- in a display, a display would normally have  
7 many devices.

8 BY MR. CUMMINGS:

9 Q What role do the thermal characteristics play  
10 in a display device?

11 A Well, the same role they do in every device.  
12 Many devices are limited, ultimately, by thermal  
13 dissipation because most semiconductors, if they get  
14 too hot, their electrical characteristics change and,  
15 in many cases, they might completely stop working,  
16 but they will definitely work differently.

17 In a single device, that's true. In a  
18 display, that's true. The style -- your ability to  
19 remove heat from the two may be different.

20 In a display, you typically have a very large  
21 number of devices in some proximity to one another.

22 In a single LED, you may just have one, with  
23 lots of, if you will, space around it, to get heat  
24 out. So they can be different, certainly.

25 Q So is thermal management an important factor

1 in designing an LED?

2 A Well, you know, with respect to -- to the  
3 '121, I don't think thermal management has been  
4 discussed at all, and I don't think the layers, and  
5 their arrangements discussed, clearly have a direct  
6 connection to thermal management.

7 In a broader sense, yes, thermal management  
8 is a topic, that if you're actually going to build  
9 something, you need to be -- have some awareness of.

10 Q What's covered by electronic device design?

11 A Well, I think it's -- it's a somewhat  
12 broader -- optoelectronics, I would say, is a subset  
13 of electronic; but electronic systems, some don't  
14 involve light in any fashion. A power MOSFET doesn't  
15 typically have much to do with light. It's an  
16 electronic device design.

17 Q Are there any optoelectronic devices that  
18 don't emit light?

19 A Oh, well, okay, yes, of course. Optical  
20 detectors. A camera chip is an optoelectronic  
21 system; and the individual photodetectors inside it,  
22 as well as their arrangement relative to lenses,  
23 other optical components, as well as their electrical  
24 characteristics, are all an optoelectronic device  
25 design.

1           That's designed to convert light into  
2   electrical signals. So they don't emit light. They  
3   certainly interact with light. They absorb it.

4           Q   Are there different considerations in the  
5   design of detectors as opposed to emitters?

6           A   Certainly there are. Most detectors won't  
7   emit or will emit poorly. Many emitters will either  
8   not detect or detect poorly because they have been  
9   optimized for different things.

10          Q   Would the thermal management be an issue in  
11   detectors?

12          A   Certainly. The absorption of light  
13   converts -- if it's a light-to-charge conversion, in  
14   an ideal world, you want all the light that gets  
15   absorbed to be turned into charge. Unfortunately,  
16   that's rarely the case. Some of that light gets  
17   absorbed and converted into heat.

18                So, yeah, thermal issues. One type of  
19   infrared device that I and my research group did a  
20   great deal of work on actually converts light to  
21   heat, and then the heat is converted to an electrical  
22   signal. So that was all about thermal management.

23          Q   Do you have any experience working with  
24   cathode-ray tubes?

25          A   A limited amount. I have not built a

1 cathode-ray tube.

2 I have worked on what's called vacuum  
3 electronics and some rather exotic types of detectors  
4 where field emission, which is one of the techniques  
5 used to generate the so-called cathode rays, in a  
6 cathode-ray tube, was the transduction mechanism; but  
7 in that case, I don't think it -- that particular  
8 device, there wasn't a phosphor to convert that into  
9 light, as there would be in a CRT. I actually have  
10 done some work on phosphors but not really  
11 specifically for use in CRTs.

12 Q Is the design of a CRT similar to that of an  
13 LED display?

14 A No. I would say a CRT design is  
15 substantially different. I don't know whether --  
16 well, there are some planar field-emission devices;  
17 but the classic CRT is a vacuum device using high  
18 voltages to generate an electron beam, electric  
19 fields to steer that beam, in some cases magnetic  
20 fields to focus it, and the phosphor for color CRT, a  
21 moderately complicated set of phosphors. Those are  
22 very different structures than you'd find in an LED.

23 Q Do you have any experience working with  
24 capacitive touch?

25 A Some, yes.

1 Q Can you describe that experience?

2 A Well, I did, and my -- my students and I did  
3 a great deal of work on a variety of sensors. Force  
4 transducers was one of the things that we did do  
5 quite a bit on. Very small force transistors,  
6 so-called microelectromechanical systems.

7 In force transduction, you can either stress  
8 -- you can either detect -- well, there are multiple  
9 quantities you can detect. One is a change in  
10 capacitance.

11 Our own research, we were more interested in  
12 other transduction mechanisms; but in order to  
13 understand if our other transduction mechanisms might  
14 have an advantage, we had to compare them to the --  
15 sort of, a classic capacitance transducer.

16 Q And is that within the definition of  
17 "optoelectronics"?

18 A Well, the capacitance transducer, I --  
19 inasmuch as those use capacitance change, that's not  
20 normally sensed using an optical signal.

21 Now, I actually did do a lot of work on what  
22 are called membrane transducers, where we used the  
23 change in optical reflectants as the transduction  
24 mechanism, but those weren't capacitive sensors.

25 A capacitive sensor -- capacitance is an

1 electrical-effect change, not an optical change,  
2 normally.

3 Q What about capacitive-touch screens? Do you  
4 have any experience there?

5 A Again, only -- only as it would relate to the  
6 individual transducers.

7 The only other work I did a little bit on,  
8 relative to touch displays, were using infrared  
9 systems as opposed to capacitance.

10 Q All right. Before I start my next line of  
11 questioning, do you want to take a break and go off  
12 the record?

13 A Yes, that would be -- that would be fine.  
14 Five minutes would be plenty for me.

15 MR. CUMMINGS: All right. Let's do a  
16 five-minute break.

17 MR. LONEY: If we can stay down on the record  
18 for a second.

19 Dean, if you could drop off, that would be  
20 great. Just make sure you can't hear. I just want  
21 to speak with counsel for a minute.

22 THE DEPONENT: I will turn off my audio.

23 MR. ERICKSON: Okay. You're muted. I just  
24 want to make sure you can't hear me. Okay. Great.

25 THE VIDEOGRAPHER: Okay. Off the video

1 record --

2 THE DEPONENT: Wait, wait, wait.

3 MR. ERICKSON: We should stay on the record  
4 for just a second.

5 THE DEPONENT: Hold on. I'm still hearing.  
6 I turned off my microphone. Let me do the -- I'm  
7 going to turn off my audio.

8 MR. ERICKSON: Turn it off completely,  
9 please.

10 THE DEPONENT: Turn off the audio. Okay. So  
11 hopefully I can no longer hear anything. I'm going  
12 to turn off my microphone now.

13 MR. ERICKSON: Great.

14 THE DEPONENT: And step away.

15 MR. ERICKSON: Thanks, Dean.

16 THE VIDEOGRAPHER: Okay.

17 MR. ERICKSON: Okay.

18 THE VIDEOGRAPHER: Off --

19 MR. ERICKSON: No, we are still on -- we can  
20 stay on the record. I just want to note that, you  
21 know, I would hope that the questioning is more  
22 tailored to these IPRs. There was a lot of questions  
23 about, for example, electrode. That is a term that  
24 doesn't even appear in any of these patents that I'm  
25 aware of.

1           It is obviously a claim-construction dispute  
2   in other patents, in the other litigation between the  
3   parties, and I'm not sure what capacitive sensors  
4   have to do with these IPRs.

5           So I just wanted to note for the record that  
6   we request that counsel try to focus his questioning  
7   better on the issues on which Dr. Neikirk has applied  
8   in these two IPRs. That's all I had. We can go off  
9   the record now.

10           THE VIDEOGRAPHER: All righty. Off the video  
11   record at 10:52 a.m.

12           (Off the record.)

13           THE VIDEOGRAPHER: On the video record at  
14   10:58 a.m.

15   BY MR. CUMMINGS:

16       Q   Dr. Neikirk, did you talk with anyone during  
17   the break?

18       A   **I spoke to my wife.**

19       Q   You didn't speak with counsel?

20       A   **No, I did not.**

21       Q   All right. I'd like to turn to paragraph 25  
22   of your declaration.

23       A   **I have it in front of me.**

24       Q   Do you see the drawing?

25       A   **The drawing on the page -- above paragraph 26**

1 on page 15? I do.

2 Q Yes. Did you prepare the annotations in this  
3 figure?

4 A So I -- I had assistance in -- in getting the  
5 graphic done; but the identification of the layers --  
6 I don't know that I picked orange and yellow and  
7 green as the specific colors; but the identification  
8 of the layers that I wanted to highlight, yes, I  
9 participated in that. That -- those are the ones I  
10 wanted to be able to call out.

11 Q And is passivation layer 212 shown in white?

12 A I've got to refresh my memory as to which  
13 numbers correspond to what.

14 Q Okay. I believe it's --

15 A So --

16 Q -- in paragraph 27.

17 A Let's see. The layer 212 -- I'm just looking  
18 for it. Oh, there it is. Yes, I'm sorry. It's  
19 actually in paragraph 27. I was actually also going  
20 to check the patent. I think the cite there in  
21 paragraph 27 would be where I also would have gone.

22 But yes, 212, in that figure, I don't think  
23 it actually is colored white. I think the -- from  
24 the original patent document, that layer was white,  
25 and it simply was not changed at all.

1 Q And second metal pattern 210B is annotated in  
2 blue; is that correct?

3 A Blue. There it is. Yes. I'm just  
4 double-checking the numbers. Some of these get kind  
5 of hard to see.

6 Yes, 210B is in blue.

7 Q Is second metal pattern 210B an organic or  
8 inorganic material?

9 A So 210B itself, if we look to -- so in my  
10 paragraph 27, but on the next page, page 16, I've  
11 identified second metal patterns 210A and 210B. So I  
12 indicate it's metal, which I believe also corresponds  
13 to the disclosure in the patent, and normally I  
14 wouldn't refer to a metal as an organic, although  
15 there are organic conductors, but I usually wouldn't  
16 call that organic conductor a metal.

17 Q And then 214C is an indium tin oxide; is that  
18 correct?

19 A So in my Figure 2 on page 15, 210C -- I'm  
20 sorry. 214C, you asked about, is -- I guess I  
21 describe what I'm looking at as a slightly darker  
22 blue. I'm sorry. Let me look at the PDF, as well.  
23 I have my printed copy, and then the colors are  
24 influenced by the inkjets.

25 And in the PDF, I think it shows up as a

1 slightly darker blue, so that's 214C.

2 I don't believe I discussed 214C in paragraph  
3 27 in my declaration, but -- that's white.

4 Q You could refer to paragraph 29.

5 A Yes. And in paragraph 29, where I do  
6 identify 214C, an anode, as being indium tin oxide,  
7 or ITO for short, yes.

8 Q Is ITO an organic material?

9 A No.

10 Q And referring to Figure 2, which is annotated  
11 on page 15, ITO pattern 214C connects to second metal  
12 pattern 210B through the passivation silicon nitride  
13 layer 212; is that correct?

14 A I'm sorry. You asked if 214C connects to  
15 what layer?

16 Q The 210B --

17 A Ah.

18 Q -- shown in blue.

19 A Yes, I just had to find the 210B. Yes, it  
20 does connect to 210B; and in that cross-section,  
21 there is indicated a -- if you will, a via or a  
22 pass-through or a hole that has to be made in layer  
23 212. 212 is a silicon nitride layer, yes.

24 Q So how would that hole be made in layer 212?

25 A Well, the most common -- well, there are a

1 variety of ways it can be made. A very common way  
2 would be to use an etching process to make a hole in  
3 a continuously -- in a layer, or a sheet, if you  
4 will, of silicon nitride that had been formed across  
5 an entire sample. So you would use potentially  
6 probably photolithography and etch to make that hole.

7 There are other methods besides etch. You  
8 can use laser ablation. You can use a laser-driven  
9 plasma etch. There are some others, but the most  
10 common would be to form a photolithography pattern,  
11 use that as a mask for an etch.

12 Q Are there any difficulties in etching a  
13 silicon nitride layer?

14 A Etching silicon nitride is very common. I  
15 wouldn't say it's more difficult than etching many  
16 other layers. Each layer requires a proper etchant  
17 chemistry and environment. Doing silicon nitride is  
18 no harder or easier than many other things. You do  
19 them -- do many different layers in an integrated  
20 circuit or a multi-layer -- multi -- multiple-layer  
21 system or device.

22 Q Can you step me through, layer by layer, how  
23 Figure 2 would be manufactured?

24 A Well, I can certainly identify a set of  
25 processes that could be used. Not necessarily the

1 only.

2 Typically, you start at the bottom and work  
3 your way up. The first layer most likely would be  
4 202B. That would be deposited, and then a  
5 photolithography-and-etch process used to form the  
6 desired pattern in 202B.

7 It would be overcoated with layer 204.  
8 Again, poten -- quite likely photolithography and  
9 etch would be used to make the desired pattern in  
10 that layer.

11 Looking at the stack -- have to check for  
12 206A and B. Look at those two. 206A.

13 No, on paragraph 27 I identify what 206A is.  
14 I use light green. It is a metal pattern.

15 The layer 206B is darker green. Let's see.

16 So in paragraph 27, on page 16 of my  
17 declaration, again this is all from the patent, from  
18 the 1 -- from the '121 patent. It states that it's  
19 possible that the metal pattern 2 -- 206A could be  
20 formed -- 206B.

21 So that -- the first sentence there, which I  
22 think is coming from column 4, 66, through column 5,  
23 line 11, in the patent itself, indicates that those  
24 two could be the same metal. If they were the same  
25 metal, you could do a blanket deposition of that

1 metal, all the way across -- let's see. I'd gotten  
2 you up through layer 204.

3 So the material for 206A and B could be  
4 blanket deposited. Photolithography could be used --  
5 photolithography and etch to produce the desired  
6 pattern.

7 The next layer in this proposed process  
8 sequence would be 208. A blanket deposition followed  
9 by photolithography and etch to provide -- to produce  
10 the desired pattern.

11 The next layer, 210A and B. 210A is referred  
12 to as the second metal pattern, and 210B is also  
13 second metal pattern. So a simple way to do that  
14 would have been a blanket deposition across  
15 everything, followed by photolithography and etch to  
16 produce the desired pattern.

17 The next layer would appear to be 212 or --  
18 not layer. That's claim language, about "sheet."

19 212 is -- that sheet would be 212. I did not  
20 color-code, and I'm not sure I called that one out  
21 directly in this section of my report; but going to  
22 the patent, 212 is described in column 5 at line 40  
23 as being a passivation silicon nitride film. So a  
24 blanket deposition of film 212, followed by  
25 photolithography and etch to form its desired

1 pattern.

2 The next layer would appear to be 214C  
3 probably. So 214C. I think we already talked about  
4 that, but that is -- that's the darker blue.

5 There it is. It's paragraph 29, of my  
6 declaration, page 17. 214C is identified by the  
7 patent, but I have explained it in my declaration as  
8 an ITO pattern. So a blanket deposition of a sheet  
9 of ITO followed by lithography and etch to pattern --  
10 to produce the desired pattern in that layer.

11 The next layer would appear to be, I believe,  
12 216. Or sheet. I want to be careful about not using  
13 claim language.

14 216 is a sheet, that could be deposited as a  
15 sheet. It is -- 216.

16 Again, I didn't separately color-code that  
17 one, but it's identified in the patent, and I  
18 discussed it in my paragraph 27 as "capping silicon  
19 nitride." So a blanket deposition of that sheet of  
20 silicon nitride, followed by lithography and etch, to  
21 produce its desired pattern.

22 The next indicated number is 218. I believe  
23 we just did 216. Yes, 218, which I highlighted in  
24 yellow in that figure above paragraph 26.

25 218 is identified by the patent, and I

1 pointed this out in my paragraph 27 as an organic  
2 layer. So that would be another blanket deposition;  
3 and if there was need to form a pattern in that,  
4 lithography and etch would be done.

5 In the particular cross-section we use -- we  
6 see in Figure 2, there is no pattern obvious, but  
7 there might be some regions where it is removed.

8 Then the next sheet, or next number, is  
9 listed as 220, which I did highlight as orange,  
10 called it out in my paragraph 27. The patent  
11 identifies as being a third metal layer, so that  
12 metal would be blanket deposited, and whatever  
13 desired pattern would be formed using lithography and  
14 etch.

15 So that -- that would be a sequence of  
16 process steps that could produce something as shown  
17 or illustrated in Figure 2.

18 Q And you made some distinguishment between the  
19 term "layer" and the term "sheet." Can you explain  
20 what the difference would be, if any?

21 A Well --

22 MR. LONEY: Object to form.

23 THE DEPONENT: "Layer" is a claim term, and  
24 the patent itself gives examples where something that  
25 is called -- that it calls a layer is actually made

1 of two other lay -- in fact, I believe it says two --  
2 two layers of material.

3 It -- it -- there are other places in claims,  
4 for instance, where it says "a given layer  
5 comprises," and then it gives an example. Of course  
6 "comprises" means it could be more than one thing.

7 So I was trying to distinguish. You asked  
8 for a process flow; and if one of these layers in  
9 Figure 2 is actually made of more than one layer,  
10 there would have to be more than one sheet  
11 deposition -- blanket sheet deposition.

12 So I was trying to use a -- a word about the  
13 processing step. So I called -- I think I tried to  
14 -- tried to consistently -- I probably wasn't  
15 completely consistent -- but I tried to refer to it  
16 as a blanket deposition of a sheet.

17 So you think of something that covers  
18 everything at that point, whereas I want to be  
19 careful about the word "layer" because it's a claim  
20 word. It's a word in the written description of the  
21 patent that has other explanations about it that  
22 might -- you know, process flow -- require the  
23 deposition of two blankets. So that would actually  
24 be two steps. Not one.

25 Q Is the term "layer" normally used in the art?

1           A    It's a word, again, that's very  
2 context-sensitive. "Layer" will have a meaning to  
3 one of ordinary skill. It has a plain and ordinary  
4 meaning in the context in which it's used. So I -- I  
5 can't give you a universal definition of that word.  
6 I need to know the context.

7                   In this patent, it -- the context is made  
8 clear as to what "layers" -- what that word indicates  
9 to one of ordinary skill.

10                  In a different patent, it might -- one of  
11 ordinary skill might very well understand it to be  
12 something different.

13           Q    All right. Let's take a look at paragraph 44  
14 of your declaration. Can you let me know when you're  
15 there?

16           A    I'm at paragraph 44.

17           Q    Towards the end, you state that first 17 and  
18 second 19 planarization films correspond to a second  
19 dielectric layer; is that correct?

20           A    I'm sorry. I have to find -- could you read  
21 that quotation again? I -- I think I found mine in  
22 the paragraph.

23           Q    "A second" -- quote, A second dielectric  
24 layer, parentheses, first 17 and second 19  
25 planarization films, end quote.

1           A    And I'm sorry; I'm having a hard time  
2 spotting this in that language. In paragraph 44. I  
3 don't suppose you happen to know how many lines down  
4 in 44 you started that. It would speed it up.

5           Q    It's the third from the bottom is where it  
6 starts.

7           A    The third from the bottom. Okay. "A second  
8 dielectric." I've got it now, yes.

9                   And yes, that was a direct quote from -- from  
10 what I have there, yes.

11                   Now, to be clear, the parentheticals are  
12 mine. The words not in parentheses is a direct  
13 quotation from element 1C of the '121 patent, just to  
14 be clear.

15           Q    So it's a -- your understanding that first 17  
16 and second 19 planarization films, of the reference  
17 you're applying, corresponds to the claimed second  
18 dielectric layer?

19           A    Yes, that is correct. So 17 and 19, we can  
20 see them illustrated in a cross-section on the next  
21 page, from the reference from Anzai. We're  
22 discussing Anzai here.

23                   So 17 and 19, in my opinion, would constitute  
24 the second dielectric layer as required by element 1C  
25 of the '121 patent.

1 Q Okay. I'm going to mark the Anzai reference  
2 as Exhibit 2 and put it in the chat. Can you let me  
3 know when you have that open?

4 A I will. I'm going to try and open it now.

5 And yes, I have it open. For clarity, the  
6 document I have says at the bottom "Exhibit 1003."

7 Q Yes. It is Exhibit 1003 in IPR2024-01132  
8 marked Exhibit 1 in this deposition.

9 A Okay. I just wanted to make sure I had the  
10 right document. I do have it.

11 Q You annotate Figure 2A of Anzai in paragraph  
12 45 at the top of page 23 of your declaration; is that  
13 correct?

14 A Yes, that is correct.

15 Q Did you make these annotations yourself?

16 A Again, I didn't actually put the colors on  
17 this figure, but these are the layers that I wanted  
18 to call out.

19 Q Did BOE's counsel annotate these figures for  
20 you?

21 A Well, I had counsel's assistance in doing the  
22 graphics. So yes, they did the graphics necessary to  
23 add those colors to those layers.

24 Q And in Figure 2A at the top of page 23, you  
25 did not color layer 17 or 19; is that correct?

1           A    That's correct. These are the figures as  
2   they stood. I mean, just for -- for the purposes of  
3   being able to read the figures 17 and 19, they are  
4   quite easy to find, even without colors.

5           Q    What does Anzai call layer 17?

6           A    17 itself, in Anzai, I believe in paragraph  
7   46. Yeah. So this is a cite, too.

8                   So in paragraph 46, there is a cite to Anzai  
9   and followed by a quotation, which is a quotation  
10  from Anzai, the site locations.

11                  And you'll notice that at the top of page 24,  
12  Anzai identifies first planarization film 17 and  
13  second planarization film 19. So that's what it  
14  identifies 17 and 19 are, at that particular point in  
15  the -- further specified them as being  
16  capacitance-insulating film.

17                  THE STENOGRAPHER: As being the what?

18                  THE DEPONENT: Sorry. As being the, to quote  
19  from Anzai, capacitance-insulating film in this  
20  configuration.

21                  So they are identified -- 17 and 19 are both  
22  identified as planarization films and that they  
23  function as the capacitance insulating film.

24  BY MR. CUMMINGS;

25           Q    Does Anzai disclose what material is being

1 used for these layers?

2 A Yes, I believe Anzai does. Let me just --  
3 oh. Let me -- you gave me Anzai electronically. I'm  
4 sorry. I don't have that on paper.

5 Let me -- so you asked about -- to be clear,  
6 are you asking about layers 17 and 19, just so I am  
7 sure I know what layers you're asking about.

8 Q (Moves head up and down.)

9 A So I believe what I quoted in my paragraph 46  
10 was in -- no. That isn't -- there is a -- it's  
11 another place where it mentions planarization films.  
12 That's in column 4. Let me keep looking.

13 17. So for instance, in Anzai, column 5,  
14 starting at line 3, it states, to quote,  
15 "Furthermore, the first planarization film 17 made of  
16 an organic resin for flattening the surface is  
17 deposited on the entire surface." So there is a spot  
18 where it identifies a possible material choice for  
19 film 17, an organic resin.

20 Q What is a planarization layer?

21 A Broadly, a planarization layer is a sheet --  
22 I'm going to sound -- of course, let's be careful  
23 about the use of the word "layer" again. Anzai is a  
24 slightly different context than the '121.

25 So a planarization -- it actually calls it a

1 planarization film 17, not layer, but that film is  
2 one that is deposited and, if necessary, further  
3 processed so that its top surface will be relatively  
4 flat.

5 Q How is a layer or sheet planarized?

6 A There are a number of ways that you can take  
7 a film that -- whose surface is not flat and make it  
8 flat. You can use polishing processes. Broadly,  
9 people tend to refer to those usually as  
10 chemical/mechanical proc -- chemical-mechanical  
11 polish processes. Very common in the  
12 integrated-circuit world.

13 You can, for some materials, heat the sample  
14 enough to cause what's called reflow. That was a  
15 technique that was used from, I believe, the  
16 seventies, on. Certainly I was aware of it in the  
17 early eighties.

18 You can use the flow properties of the  
19 material, combined with surface-tension effects, to  
20 try to cause the surface to be flattened -- flatter  
21 or flattened.

22 So there is a number of ways you could do it.

23 Q Can you describe what a polishing process is?

24 A Polishing usually refers to a mechanical  
25 process, where you bring a surface into contact with

1 a -- an abrasive polishing compound and, when done  
2 properly, it first removes high points through a  
3 mechanical abrasion and, in chemical-mechanical  
4 polish, a combination of abrasion and chemical etch;  
5 and if controlled carefully, you can do that long  
6 enough to where you end up with a surface that is  
7 much flatter than it originally was.

8 Q And can you describe reflow briefly?

9 A In reflow, it normally refers to a situation  
10 where a film is present. Its surface is not as flat  
11 as you might like it to be.

12 Through usually a heating process, you heat  
13 the material above its glass-transition temperature;  
14 and under those circumstances, it will flow, like a  
15 viscous fluid, and the -- that tends to eliminate  
16 sharp corners. It tends to flatten out the surface  
17 because surface tension wants to minimize surface  
18 area.

19 Q Can you think of any other techniques for  
20 planarization?

21 A So polish and flow are the two techniques I  
22 have used and the ones that I certainly used to teach  
23 in my course.

24 There are tricks to do that in a more  
25 localized fashion. You can sometimes use a

1 straight-etch process, but usually that doesn't work  
2 all that well because you tend to etch everything.

3 And those are certainly the two that I'm most  
4 familiar with.

5 Q Is one method preferred over the other for an  
6 organic resin?

7 A Not necessarily, no. I mean, that -- organic  
8 resins may, in some cases, be easier to reflow than  
9 other inorganic films, in which case, for an organic  
10 resin, your choice to use reflow might be enhanced,  
11 easier.

12 But when people do -- chemical-mechanical  
13 polish is very popular now because it's such a good  
14 way to do what's called global planarization, for a  
15 very large wafer.

16 The reflow processes make a surface more  
17 planar, and you would still call that a planarization  
18 film, but they can be trickier to get them to be as  
19 flat. It depends, on the application, whether you  
20 care or not.

21 Q You mentioned that chemical-mechanical polish  
22 is very popular now. When did chemical-mechanical  
23 polish become a viable manufacturing technique?

24 A IBM was using it in their manufactured  
25 product lines in the eighties. It absolutely became

1 much more widely used by many other companies in the  
2 nineties.

3 Q Is there any difference between a  
4 planarization layer and a passivation layer?

5 A Well, I believe in -- no, let's see. In the  
6 '121, I believe "capping" and "passivation" are used.  
7 I'm not sure "planarization" is used.

8 Not necessarily. A film could do -- have  
9 multiple functions. Given that the '121 actually  
10 doesn't call out any special characteristic that it's  
11 passivating for, I believe that Anzai's planarization  
12 films could act, would act as a -- as a passivation  
13 layer.

14 It typically means to protect the surface  
15 that's underneath it, and Anzai 17 and 19 would do  
16 so.

17 Q Are the terms "passivation" and  
18 "planarization" synonymous?

19 A No, I don't think they are necessarily  
20 synonymous; but in many cases, the same sheet of  
21 material can perform both functions.

22 Q Are there cases where the same sheet of  
23 material would not perform both functions?

24 A Well, if the -- if the context specified the  
25 -- I'm going to use the word "specific" twice. I'm

1 apologizing. If the -- if the situation or the --  
2 the art were to identify the type, its passivation  
3 more narrowly, and say, for instance, passivation of  
4 a silicon surface to prevent dark current, well,  
5 there are certainly films that you could deposit on a  
6 silicon surface that could be used to planarize that  
7 would not necessarily passivate that silicon surface  
8 with respect to dark current.

9           There are other film choices that might, or  
10 would. Again, I point out the '121 doesn't state  
11 that -- the kind of passivation it's referring to.  
12 It just says "passivation" broadly.

13           So yes, there are certainly some  
14 circumstances, depending on context, where  
15 passivation might be defined as being a very specific  
16 result, and then the choices for films to do that  
17 would be potentially narrow.

18           Q   Are the terms "capping layer" and  
19 "planarization layer" synonymous?

20           A   Again, I would say that they might be done by  
21 the same layer, but would not necessarily.

22           A capping layer in the '121 patent, again,  
23 there is no special explanation of what kind of  
24 capping; but in the sense of covering over structures  
25 below, then as an example, Anzai's 19 certainly caps

1 everything that's in that -- Figure 3A is illustrated  
2 as capping everything that's below. It covers over.

3 So a planarization layer might well be a  
4 capping layer.

5 Q Well, let's look then at Figure 2B or 3B.  
6 You've annotated them on page -- on the top of page  
7 29.

8 A Yes, I'm on page 29. I see the two annotated  
9 figures.

10 Q These correspond to a different portion of  
11 Figures 2A or 3A; is that correct?

12 A So let's see. So if you look at -- let me  
13 look at Anzai real quick here. 2B.

14 Okay. So on page 29, I have 2B and 3B. So  
15 these are cross-sections, and they -- what you have  
16 to be a little careful about is the cross-sections in  
17 Anzai.

18 If you look at Figure 1, you'll see a cut  
19 line. So in Figure 1 of Anzai, it's kind of hard to  
20 pick out; but if you look horizontally, on the left,  
21 look for the letter, capital "A," and then you'll see  
22 sort of a long-dashed, short-dashed line, that  
23 extends across horizontally. Then it turns at a  
24 right angle and goes down.

25 So these cross-sections are actually laid

1 along that line that's not straight. But you have to  
2 be --

3 Q Did --

4 A I'm just trying to be a little careful about  
5 what we're seeing in these. And that's true, I  
6 believe, for all of them. For 2B, 2A.

7 Let's see. 2B is in a different location.  
8 Let's see. Where is that.

9 Q But the figures are referring to the same  
10 layers?

11 A The -- the -- so 2A and -- just a second.  
12 3B.

13 So in that Figure 1, there is another cut  
14 line that's labeled "B to B," and you notice that  
15 that goes through -- they are transistor regions --  
16 that are labeled 43. Those show up in Figure 2B and  
17 3B; okay? And that cross-section is just straight  
18 across.

19 It's the "A" cross-sections that you have to  
20 be a little bit more careful about. Those show up in  
21 Figures 2A and 3A.

22 I just needed to -- the 2B's -- 2B and 3B,  
23 the cut line in Figure 1 is supposed to be that "BB"  
24 cut line. It is just straight across. So it's a  
25 little simpler.

1           Q   Thank you for that clarification. Are the  
2   layers in Figure 2A and 2B referring to the same  
3   layers?

4           MR. LONEY: Objection. Form.

5           THE DEPONENT: So for instance, in 2A and 2B,  
6   you have some layer numbers that are the same as the  
7   layer numbers in 2A, and they do refer to the same --  
8   well, Anzai refers to them as films. They do refer  
9   to the same films, the same numbers.

10          There are some shown in 2B that you do not  
11   see in 2A. The numbers -- the 60's, for instance,  
12   show up in 2B. They don't show up in 2A.

13   BY MR. CUMMINGS:

14          Q   But planarization layers 17 and 19 are  
15   present in both figures; correct?

16          A   They are. I'm sorry; I apologize for  
17   speaking over you.

18          Yes, 17 and 19 appear in both Figure 2A and  
19   2B.

20          Q   Does 19 cover all of the elements in Figure  
21   2B?

22          A   It doesn't.

23          Q   Is there any difference between a passivation  
24   layer and an insulation layer?

25          A   Yes, there can be. Sometimes the same film

1 can do both, but there are other circumstances where  
2 passivation layers aren't made of an insulator.

3 Q Can you explain that distinction a little  
4 more?

5 A Well, earlier, I mentioned a specific type of  
6 passivation with respect to dark current in -- due to  
7 a silicon surface, and one passivation layer is  
8 another doped layer of semiconductor. That's not an  
9 insulator.

10 Q What is a doped layer?

11 A A doped layer -- well, I was referring to a  
12 doped semiconductor layer. Well, ex -- again, let's  
13 not use the word "layer" because that's not the  
14 layers that we're talking about on the '121 patent.  
15 A film made of semiconductor with additional  
16 electrical dopants in it. That's a doped  
17 semiconductor film.

18 Q What properties does a doped semiconductor  
19 film have that make it desirable?

20 MR. LONEY: Objection. Form.

21 THE DEPONENT: Well, desirable -- desirable  
22 in what? Desirable in a -- in a MOSFET? You have to  
23 have a doped source and drain or you can't make a  
24 MOSFET.

25 BY MR. CUMMINGS:

1 Q Why is that?

2 A Well, a MOSFET has -- must have a source and  
3 a drain. It's a four-terminal device, two of which  
4 are -- one is a source and one is a drain, and that  
5 requires doping a semiconductor film to form that  
6 source and that drain. It -- you just can't build it  
7 without those.

8 Q All right. Looking at Figure 2B of Anzai on  
9 page 29, can you walk me through how this would be  
10 fabricated, or an example process?

11 A I want to look. I think Anzai may actually  
12 do this. Anzai has a little bit more in terms of  
13 step-by-step processing. Let me look and see.

14 So you're asking about 2B. So broadly, if  
15 you look at Anzai itself, starting at -- let's see.  
16 What's a good place to pick as a starting point?

17 Roughly, say, starting in column 3 in Anzai,  
18 at line 57 I believe, continuing all the way through  
19 column -- I think it would be appropriate to go  
20 probably to column -- all the way through column 5 at  
21 line 30 -- all the way to line 33. The entirety of  
22 that is a layer -- or a sheet-by-sheet or  
23 film-by-film. I believe Anzai uses, in many cases,  
24 the word "film."

25 And it goes through a film-by-film process

1 where it identifies when a film would be -- where it  
2 would be placed. It identifies -- let's see, column  
3 4, what those films or layers do.

4 I think it identifies formations of -- of  
5 patterns in those films and so on.

6 So in Figure 2B, for instance, what's labeled  
7 as "10" is discussed in column 3, lines 61 through  
8 about 64 in Anzai, and specifies that when a  
9 conductive substrate or a semiconductor substrate is  
10 used as the insulating substrate 10.

11 So 10 is referring to the -- if you will, the  
12 bottom, the thing on which everything else is built.

13 It specifies that the next layer -- or next  
14 film, it says, "Insulating film 12, such as SiO<sub>2</sub> or  
15 SiN should first be deposited before forming the  
16 TFTs."

17 So you end up -- it says, "Start with the  
18 substrate tin, deposit a film 12." Let's see. Let  
19 me back up.

20 Film -- let me find -- you're asking about  
21 2B. So let me find what -- there is a film there  
22 that has 43s called out for it, and it generally  
23 describes what those things -- that the 43S, 43D,  
24 source and drains of a TFT. That's in column 3 of  
25 Anzai. I'm trying to find whether it calls out the

1 layer -- or the sheet -- the film deposition step for  
2 that one.

3 And I don't think it does, although what I  
4 just pointed you to at the bottom of column 3 states  
5 that before you form the TFTs, you would place this  
6 insulating film 12.

7 So deposit film -- well, that goes over. So  
8 that's -- that's before you put the gates down. So  
9 you deposit -- well, you have 10. You have -- the  
10 way 2B is illustrated, you would deposit a layer -- a  
11 film that would be then patterned to form those  
12 structures that are labeled as 43S, C and D. All  
13 that is labeled 43. So that would be a deposition  
14 step.

15 There. It calls it out in Anzai column 4.  
16 These are the 43s. Yes. Line 52 and following.  
17 This is a polycrystalline silicon film 43. That  
18 would normally be blanket deposit -- blanket  
19 deposited and then patterned using lithography and  
20 etch.

21 It's then -- as Figure 2B is drawn, there  
22 would be a blanket deposition of film 12.

23 There would then be a blanket deposition of  
24 the film that is patterned to form the elements 41,  
25 in that cross-section. Those are gates. It would be

1 covered with the blanket deposition of film, or could  
2 be. This is one process flow.

3 Blanket deposition of layer -- of film 15.  
4 That's described -- let's see. 15. I'm looking at  
5 the text of Anzai.

6 I'm not sure -- I'm not sure it actually  
7 calls out film 15 specifically; but given where it is  
8 in that figure and its stack-up, I would expect 15 to  
9 be an insulating material.

10 There would then be photolithography and etch  
11 to form holes through 15 and 12, down to 43. There  
12 would be a blanket deposition -- let's see. It's  
13 going to form after patterning 53 and 56. Yeah, and  
14 I'm not sure.

15 There is -- so it does describe 53 as a  
16 driving source line, and 56 as a source electrode  
17 formed by filling a contact hole. So that's -- that  
18 would be a deposition.

19 It does give an example. Could be aluminum.  
20 There would have to be a lithography step to pattern  
21 that. And based on the stack-up, there would be a  
22 blanket deposition of layers 17 -- of film 17.

23 There would have to be a lithography and etch  
24 to open a contact hole through it. Most likely,  
25 then, a blanket deposition of film that makes up 61,

1 followed by lithography and etch, followed by blanket  
2 deposition of film 19, followed by lithography and  
3 etch, A blanket deposition of 62.

4 62 itself, in Figure 2B, you can't tell  
5 whether there is a pattern formed in it or not. 62  
6 -- I'm sorry. We're up to 62. I'm sorry. I'm just  
7 checking. I'm looking at Figure 1 of Anzai, the top  
8 view, to see if I see 62.

9 I'm not immediately seeing 62. I would have  
10 to do a little bit of digging to see whether 62  
11 requires lithography and etch.

12 The next layer -- the next film is 63. I  
13 would expect that would be blanket deposited and  
14 etched -- lithography and etched to form its desired  
15 pattern.

16 There is 64, which would be another film. 64  
17 itself is an electron transportation layer. That's  
18 in column 5 of Anzai.

19 Again, it's not shown that it has been  
20 patterned in Figure 2B. I'd have to take a look to  
21 see whether it would -- whether I believe it would or  
22 would not need lithography and etch.

23 And then the last layer shown is 65, and 65  
24 is a cathode layer which is called out in column 5.

25 Q And where in that process does the

1 planarization step happen for film 17?

2 A Well, Anzai says that 17 is a planarization  
3 layer. He doesn't -- doesn't give -- as I've just  
4 pointed out, he actually didn't give every single  
5 step. He didn't call out how that planarization is  
6 performed.

7 Q So if you were going to reform 17, when would  
8 that need to take place?

9 MR. LONEY: Objection. Form.

10 THE DEPONENT: Well, if you -- if you were  
11 going to do a reflow-type planarization, you would do  
12 that after you deposited layer 17 -- or film 17.  
13 Anzai calls them films.

14 It would be after the first planarization  
15 film 17 is depos -- deposited over the films that  
16 have already been patterned. That's why you end up  
17 with topography. So you flatten it before you add  
18 the next film, which in the stack-up, I believe,  
19 would be 61.

20 BY MR. CUMMINGS:

21 Q So the planarization step takes place before  
22 you add the next film; is that correct?

23 A Normally. Sometimes people will form a -- a  
24 contact hole or via before they do planarization.  
25 That's a possible option. But a pretty common option

1 would be to flatten it before you create any patterns  
2 in it.

3 Q And that holds true for reflow and polishing?

4 A Yes, although -- well, I would say that if  
5 you're polishing, it would be more common to polish  
6 before you open any -- make any openings in the film  
7 you want to flatten. For polish, I think that's  
8 probably more common you do it before, but it's not  
9 universal.

10 Q And just to be clear, we're referring to  
11 flattening layer 17 and how that's planarized?

12 A Well, yes. Anzai describes film 17 as being  
13 a first planarization film, and so the step -- the  
14 processing step to try to make the surface of 17  
15 flatter, in other words to be planarized, and planar  
16 -- to be clear, planarization doesn't require perfect  
17 flatness, normally. It rarely is. But to make it  
18 flatter, you would do that step normally before you  
19 put anything on top of that.

20 Q And the same is true for planarization film  
21 19?

22 A Yes, that's correct.

23 MR. CUMMINGS: All right. Why don't we go  
24 off the record and take a break if that's all right.

25 THE DEPONENT: Okay. Five minutes?

1 MR. CUMMINGS: Yeah. We can discuss how long  
2 off the record.

3 THE DEPONENT: Okay. I -- I will come back  
4 in five to find out what happens. Okay.

5 THE VIDEOGRAPHER: Okay. Off the video  
6 record at 12:06 p.m.

7 (Off the record.)

8 THE VIDEOGRAPHER: On the video record at  
9 12:14 p.m.

10 BY MR. CUMMINGS:

11 Q Dr. Neikirk, did you talk with your counsel  
12 during the break?

13 A I did not.

14 Q All right. I'd like to move to ground 2 in  
15 your declaration which starts at paragraph 69. Can  
16 you let me know when you're there?

17 A I am there.

18 Q Here, you rely on the Yamazaki reference,  
19 which I'm going to introduce as Exhibit 3 of the  
20 deposition. Can you let me know when you have that  
21 open?

22 A I have it open.

23 Q In paragraph 72 of your declaration, on page  
24 36, you provide an annotated Figure 2 of Yamazaki; is  
25 that correct?

1           A    Yes, it is.

2           Q    You've annotated a first area, a second area  
3   and a third area. Do you see that?

4           A    Yes. Right there.

5           Q    There are several areas that are not labeled.  
6   Do you see those?

7           A    I do.

8           Q    What are those areas?

9           A    Well, starting to the left, which Yamazaki  
10   calls out with the letter -- or the number "7" -- I'm  
11   just looking at the written description for Yamazaki.  
12   Let's see.

13                Yamazaki in column 9, line 1 through 4,  
14   states that the referenced numeral 7 denotes a  
15   connecting region for making connection between an  
16   upper electrode, common to the light-emitting  
17   elements, and wiring on the substrate.

18                So it's a -- it's a region where electrical  
19   connections are being made. Let's see. The region  
20   between what I have annotated as first and third  
21   regions -- or areas, areas, in large part corresponds  
22   to what Yamazaki labels as 40.

23                And Yamazaki refers to 40, at the bottom of  
24   column 9 and continuing to the top of column 10, as  
25   being the switching TFT.

1           And looking at that, what -- Yamazaki has a  
2   little set bracket with "40" underneath it. I can  
3   see within that, for instance labeled as 44s, those  
4   appear to be gates. 50d and 50c certainly look like  
5   they correspond probably to sources and drains. I'd  
6   have to go through.

7           But that that corresponds to a region where  
8   transistors are formed, switching TFTs in particular.  
9   That fits the diagram.

10          It just so happens that Yamazaki extends that  
11   set bracket far enough to, broadly speaking, include  
12   this via that he labels 47-48 which are to make  
13   electrical connections to -- let's see. 47 and 48  
14   are -- let me make sure that's -- that's that.

15          Simply looking at the figure, they look like  
16   the connections down to the TFTs. I was looking in  
17   the specification of Yamazaki to see if it calls out  
18   what 47 and 48 specifically are.

19          So I see one reference that would include 47  
20   and 48. Yamazaki column 19, starting at line 53,  
21   talks about electrodes 23 to 27 and 46 to 48, and  
22   then identifies metals that could be used to form  
23   those. So broadly speaking, he's referring to 47 and  
24   48 as electrodes.

25          And then the next area I have annotated is

1 third area. The next is secondary. So those are the  
2 only areas that I didn't include was Yamazaki 7 and  
3 basically Yamazaki 40.

4 Q Looking at paragraph 74 now, you point to  
5 insulation layer 30 as teaching that silicon nitride  
6 is a suitable material for insulation 30; is that  
7 correct?

8 A Yes, that -- so paragraph 74. And yes, those  
9 citations in Yamazaki are about -- there may be other  
10 layers that, specifically, they are about: layer 30  
11 and a teaching of how to flat -- how to make the top  
12 surface flat.

13 Q And the teaching of how to make the top  
14 surface flat refers to chemical-mechanical polish; is  
15 that correct?

16 A Yes. In Yamazaki, I know he certainly does  
17 mention -- and I don't remember whether he calls it  
18 CMP. Let me look at the citation I have of column  
19 20.

20 Yes. So in column 20, at lines 17 and  
21 following, it states, "In addition for flattening the  
22 surface." Now, that one says they are talking about  
23 28a, but that one mentions, "Any flattening process,  
24 such as CMP, may be formed" -- "may be performed."

25 And it calls out, "After formation of first

1 load 20" -- "electrode 28a or after the formation of  
2 an insulating material 30."

3 So it's explicitly stating that to flatten  
4 30, you can -- could perform CMP, and that's an  
5 example. "Any flattening process such as CMP."

6 It goes on to make some comments about other  
7 films, such as 22, that might be desirable if you're  
8 going to do CMP with 30, but not required.

9 Q Would it be possible to use reflow with 30?  
10 Is that one of the "any other flattening processes"  
11 that Yamazaki describes?

12 A So I don't believe -- I think Yamazaki only  
13 points -- points to any flattening process and then  
14 gives, as an example, CMP.

15 I don't think Yamazaki happens to point to a  
16 reflow process, although he does state that 30 may be  
17 formed of an organic resin or an insulating film,  
18 including -- including silicon.

19 So it -- for instance, that word is going to  
20 mention -- that's for 30. So he mentions an  
21 insulating film including silicon. Well, silicon  
22 nitride would be such a film.

23 I think there is a -- there was another spot  
24 where it's -- it actually lists silicon nitride as an  
25 example material.

1 I'm sorry. This is 30. 11. So that's  
2 actually earlier than where I am right now.

3 So back in column 11, Yamazaki points out  
4 that insulating material 30, and he gives a  
5 relatively long list of materials that could be used,  
6 including photosensitive or non-photosensitive  
7 organics or -- keep reading down.

8 I think we need to go on to -- what's that?  
9 Oh. Yes. I'm sorry. It's right there. Line 48,  
10 "The insulating material 30 may be an inorganic  
11 material such as silicon oxide, silicon nitride or  
12 silicon oxynitride" -- "nitride."

13 So all of those are things that Yamazaki  
14 indicates you could use for 30. And as an example,  
15 again we were talking about CMP, he states you can  
16 use any flattening process and then it's a "such as  
17 CMP."

18 So I don't believe Yama -- Yamazaki  
19 explicitly states -- gives examples of other  
20 flattening techniques. It clearly indicates you have  
21 choices. CMP is one, and that's the one he mentions  
22 in his words, "Such as CMP."

23 Q Would you use reflow with a silicon nitride  
24 material or just CMP?

25 A Broadly, I would normally not expect to use

1 reflow with silicon nitride. The glass-transition  
2 temperature for pure silicon nitride is relatively  
3 high. It's actually pretty common to use a doped  
4 glass and reflow.

5 Those are usually oxynitrides, which is  
6 another example that Yamazaki gave earlier; but for a  
7 pure nitride, probably not.

8 Q Is there a difference between a gate oxide  
9 layer and an oxide layer?

10 A Not necessarily. A gate oxide layer refers  
11 to an oxide placed in a specific location relative --  
12 in a MOSFET normally. Normally between gate and  
13 channel.

14 Q Is there any difference with how that is  
15 formed?

16 A Not necessarily.

17 Q All right. I'll move on to paragraph 110,  
18 and this is in ground 3 now.

19 A Okay. I'm at paragraph 110.

20 Q So here, instead of modifying Anzai with  
21 Yamazaki, you're proposing to modify Yamazaki with  
22 Anzai; is that correct?

23 A Just one moment.

24 3. So yes, that's correct. Yamazaki -- in  
25 ground 3, I've identified Yamazaki as, to use the

1 euphemism, the primary reference, and it's done in  
2 view of Anzai.

3 So yes, paragraph 110 and this whole section,  
4 that's the analysis on it I'm doing.

5 Q So in paragraph 111, you provide an annotated  
6 Figure 2 of Yamazaki; is that correct?

7 A Yes, it is correct.

8 Q How would you modify this figure in view of  
9 Anzai?

10 MR. LONEY: Objection. Form.

11 THE DEPONENT: So the claim element we're  
12 talking about, and we're talking about claim 3, and  
13 claim 3 itself requires device of claim 1, wherein  
14 the second dielectric layer, which in analyzing  
15 Yamazaki, in my opinion, would correspond to material  
16 30 in that Figure 2, comprises a passivation layer.  
17 Again, in my opinion, that would be insulating  
18 material 30 in Yamazaki. And a capping layer.

19 So in claim 3, there is an example where  
20 there is one thing described as a die -- a second  
21 dielectric layer, that comprises, so it has at least  
22 two other layers within it, a passivation layer and a  
23 capping layer.

24 And if we look to Anzai, he uses examples  
25 where there are two layers used, and so the -- that's

1 -- let's see. This is -- if you skip forward to  
2 paragraph 116, I discussed those first and second  
3 planarization layers.

4 So in paragraph 118, the combination, really,  
5 is to add planarization layer 19 from Anzai to be on  
6 top of insulating material 30.

7 And I point out before that, in the preceding  
8 paragraphs, that in fact, Yamazaki itself has shown  
9 examples, Figure 15A on page 61, where Yamazaki  
10 already added a layer on top of what would cor -- or  
11 a film on top of what would correspond to film 30.

12 So this is a combination that is actually  
13 already, if you will, hinted at, one of ordinary  
14 skill looking at Yamazaki, seeing the structures,  
15 seeing the layers, seeing and teaching where there  
16 are two layers, would be motivated, in my opinion, to  
17 look to other references where two layers are used.  
18 And Anzai is such an example.

19 Q So adding another layer to Figure 2 on top of  
20 layer 30 is what you're proposing?

21 A So be -- in that process sequence --  
22 remember, we got to a step of a blanket deposition of  
23 30, before adding 32. You would simply do a blanket  
24 deposition of 30, followed by what Anzai referred to  
25 as its -- let me find that. Planarization layer -- I

1 believe Anzai calls it planarization layer 19. Let  
2 me go back to Anzai again and make sure I've got the  
3 right number.

4 Q I believe you do.

5 A Yeah. Yeah, 19. Yes.

6 So, yes, you would do a deposition, put down  
7 30, put down 19.

8 30 itself, you might well do -- depends on  
9 what materials you choose and what planarization  
10 techniques you use, but you might planarize 30 and  
11 deposit 19.

12 If 30 was already planarized, 19 still  
13 remains planar. It's still a planarization layer but  
14 might not require additional planarization.

15 Then you would define the pattern in Figure 2  
16 of Yamazaki.

17 If you look at those dips, if you will, in  
18 the orange layer, where it goes down, you would do  
19 that lithography on the combination of 30 and 19 --  
20 the lithography and etch -- to open those windows.

21 And then you would simply follow it with -- I  
22 believe the next layer in sequence is the yellow  
23 layer 31 -- or next film is yellow film 31.

24 And then I think the -- there is a  
25 lithography and etch step of that, and then 32 and

1 lithography and etch.

2 MR. CUMMINGS: All right. I believe that's  
3 all I have for the '121 patent at this time.

4 Zach, do you want to do the redirect now or  
5 do you want to do it combined with the '477 patent?

6 MR. LONEY: We are -- we are going to wait  
7 and do our redirect on both patents at the end.

8 MR. CUMMINGS: Great. Do you want to go off  
9 the record and take a lunch break now?

10 THE DEPONENT: That's fine with me.

11 MR. LONEY: Yep. Let's do it.

12 MR. CUMMINGS: All right. We'll go off the  
13 record.

14 THE VIDEOGRAPHER: All righty. We're going  
15 off the video record at 12:38 p.m.

16 (Off the record.)

17 THE VIDEOGRAPHER: On the video record at  
18 1:28 p.m.

19 BY MR. CUMMINGS:

20 Q Dr. Neikirk, did you talk with counsel during  
21 the break?

22 A I did not.

23 Q Now we're going to be talking about  
24 IPR2024-01315, and this covers patent number  
25 8,158,477, which we'll refer to as the '477 patent.

1 Do you understand?

2 A I do.

3 Q All right. I'm going to mark your  
4 declaration for the '477 patent at Exhibit 4 and put  
5 it in the chat. Can you let me know when you have it  
6 open?

7 A Well -- and I do have it open.

8 Q All right. Looking at paragraph 5, your  
9 background and qualifications are the same as your  
10 previous declaration?

11 A Yes, they are.

12 Q And your definition of a person of ordinary  
13 skill in the art is the same?

14 A Yeah, I believe it is. I -- you know, I  
15 noticed -- I'm trying to look to see if there is  
16 maybe one word that is different. I don't think that  
17 there is any difference of any matter; but if we  
18 compared it, there might be one word that's  
19 different. Let me -- let me look.

20 Page 14.

21 I -- it's certainly for -- it's -- in terms  
22 of any words that matter, it's identical, and it may  
23 very well be absolutely identical. I couldn't recall  
24 whether there was one word that changed somehow or  
25 not.

1 Q Is it your understanding that the '477 patent  
2 and the '121 patent are in a related family?

3 A Yes, I do.

4 Q Or are in the same family. Sorry.

5 A Excuse me. Yes, I do understand that.

6 Q And you rely on several of the same  
7 references in the '477 patent as you do in the '121  
8 patent; correct?

9 A Yes, that is correct.

10 Q Beginning with paragraph 57, this is your  
11 ground 1. Can you let me know when you're there?

12 A I'm there.

13 Q Is your understanding of Anzai the same in  
14 the '477 patent as it is in the '121, or are there  
15 any distinctions you would like to make with respect  
16 to its teachings?

17 MR. LONEY: Object to form.

18 THE DEPONENT: Let me -- let me look. In  
19 general terms, of course Anzai remains Anzai. There  
20 was -- let's see.

21 For previous document, there were certain  
22 regions that I focused on. I -- if I recall  
23 correctly, for the '171, there may have been a bit  
24 more focus on one transistor versus -- I'm trying to  
25 recall.

1           It seems there was some discussion, I think,  
2   that tended to focus a bit more on the access  
3   transistor as opposed to the drive transistor in the  
4   '477. I believe there is a bit more focus on the  
5   drive transistor.

6           So there may be some slightly different  
7   focuses; but in terms of the teachings of Anzai, that  
8   hasn't changed, and I haven't seen any -- there is  
9   nothing different in that sense.

10   BY MR. CUMMINGS:

11       Q   And when you refer to the drive transistor,  
12   what structure are you referring to?

13       A   Let me look here real quick.

14           So in the '477, in the claims, there is a  
15   requirement for first area -- let me find it. First  
16   area. First area.

17           Actually, I'm -- I'm looking at the claims of  
18   the '477 right now; and in claim 1, for instance,  
19   there is a first area, a required second area, and a  
20   required -- it was required earlier. Give me just a  
21   moment.

22           No, first and second areas.

23           For instance, on page 25 of my declaration,  
24   I've identified second area and a first area in plan  
25   view in the figure just above paragraph 61. And the

1 orange rectangle there is calling out a second area,  
2 which claim 1 identifies as a second area for a  
3 transistor on the substrate.

4 The transistor that I'm discussing there,  
5 transistor -- broadly, I'll call it transistor 41.

6 If you look back on the electrical schematic  
7 on page 22 of my declaration, for the '477, you'll  
8 see that transistor to the right. That is a drive  
9 transistor for the LED.

10 The other two transistors, which let's call  
11 31, for simplicity, are access transistors. So the  
12 area that I'm going to look at and explain its  
13 presence in Anzai corresponds to the drive  
14 transistor, just to give it a name. But it's the  
15 region that contains the transistor 41.

16 Q Referring to paragraph 66, you talk about an  
17 alternative read on Anzai. Can you explain what the  
18 distinction is with this read?

19 A One moment to read through that paragraph.

20 So this is the section about element 1b and,  
21 in particular, is looking at the required --  
22 requirements from the '477, claim 1, defining at  
23 least the first area or -- and a second area.

24 So in paragraph 61 through 65, I was  
25 discussing the different regions that could satisfy

1 that.

2 In paragraph 66, I'm simply pointing out that  
3 it's an obvious design to place Anzai's stacked  
4 capacitor in -- let's see. There -- there are some  
5 layers -- some films, layers, that are common between  
6 the areas, and a POSITA would know that you have a  
7 choice between adding layers and then you could end  
8 up with some of these components overlapping in the  
9 same area, or you would actually just simply put them  
10 in separate areas.

11 Anzai's Figure 1, for instance, puts them in  
12 separate areas. And so I'm simply pointing out that  
13 it's obvious with Anzai that you would -- that you  
14 could and would put them in separate areas. It's --  
15 it's both disclosed and obvious.

16 Q Looking at paragraph 67 now, you map Anzai's  
17 electrode layer 54 to be the, claimed, first  
18 conductive layer. Do you see that?

19 A Yes.

20 Q What is electrode layer 54?

21 A So 54, you can see it in the cross-section,  
22 and I'll -- it's -- it has a shape that you might  
23 call a plate.

24 If you look at the plan view, back on page  
25 25, you can identify where 54 is. It's, roughly

1 speaking, rectangular. It has extensions from either  
2 side of it, as well; but roughly speaking, it is a  
3 rectangle. So that object that makes -- this is  
4 Anzai. So let me open my copy.

5 So Anzai was Exhibit 2, I believe. And we're  
6 discussing 54.

7 Anzai itself describe -- shows -- let's see  
8 where it discusses that.

9 In column 4, for instance, at line -- I think  
10 it's 28. It starts at 28. It says, "The second  
11 capacitance electrode layer 54." So that is a plate  
12 that is forming part of the capacitor.

13 Q Is there a term for a plate that is forming a  
14 part of a capacitor? Is that known as an anode?

15 MR. LONEY: Objection. Form.

16 THE DEPONENT: So not normally. Anzai itself  
17 uses the word "electrode layer." And I think we  
18 talked about electrode this morning. That's a term  
19 that is quite broad, and it depends on the context --  
20 context. It's not unusual to refer to one of the  
21 conductive parts that provide area, in a capacitor,  
22 as an electrode.

23 It would only be called an anode if you were  
24 using a capacitor that is polarized; okay? Anode is  
25 the positive terminal. This capacity -- these

1 capacitors are unlikely to be polarized. Many, many  
2 capacitors are not.

3 And so the -- the various conductive  
4 structures that provide the area of the capacitor,  
5 it's only in a polarized capacitor where one of them  
6 would actually be called an anode.

7 BY MR. CUMMINGS:

8 Q I think I see. So the -- the surface area of  
9 the capacitor is the electrode?

10 A Well, so --

11 MR. LONEY: Objection. Form.

12 THE DEPONENT: -- the electrode, as used --  
13 as the term is used in Anzai, is this is a conductive  
14 structure which is providing space, area, upon which  
15 charge will reside when a capacitor is charged.

16 BY MR. CUMMINGS:

17 Q Earlier we talked about how one would form  
18 the structure of Anzai, an exemplary process. That's  
19 the same here, as it was earlier, isn't it?

20 MR. LONEY: Objection. Form.

21 THE DEPONENT: It would certainly be -- I  
22 don't remember which example I gave you. I think I  
23 walked through the -- the stack-up. I don't remember  
24 whether I used 2A, but I probably did.

25 And for -- then that stack-up would still be

1 the same if the reference figure is 2A.

2 We did, I believe, discuss different  
3 embodiment this morning. Let me just use Anzai --  
4 Anzai itself.

5 So for instance, I -- I think we may have  
6 talked our way through the layer-by-layer -- or the  
7 film-by-film of Figure 2A.

8 We may also have done 3A. I've forgotten  
9 whether we did both.

10 Obviously there is -- there are more films in  
11 Figure 3A than there are in 2A. So there is a  
12 difference between those two.

13 BY MR. CUMMINGS:

14 Q Well, I'll move on to ground 2, and I believe  
15 this starts in paragraph 139 --

16 A Yes, I have paragraph 139 in front of me.

17 Q This is the same combination you made for the  
18 '121 patent; is that correct?

19 A So I did consider a combination of Anzai in  
20 view of the Yamazaki for the one-to-one, yes.

21 Q Then in ground 3, you introduce Yamada; is  
22 that right?

23 A Ground 3, I believe -- I think it starts in  
24 paragraph 166. So again, for ground 3, it's Anzai in  
25 view of Yamada. So, yes, that's where I used --

1 where I have considered the combination with Yamada.

2 Q Okay. I'll introduce Yamada as Exhibit 5.

3 Can you let me know when you have it open?

4 A I will. I'm just -- my internet connection  
5 is slow. I'm going to make sure it actually has  
6 downloaded.

7 Yes, I have Yamada open, and I can see the  
8 file, yes.

9 Q In paragraph 174 of your declaration, you  
10 state that Yamada teaches the same layers as Anzai,  
11 including layers 17 and 19. Do you see that?

12 A I do.

13 Q And then a few sentences later, you say,  
14 "Yamada differs from Anzai by expressly teaching that  
15 layer 19, quote, may be composed of a single layer of  
16 SiO<sub>2</sub> film or SiN film or a lamination of those  
17 films," end quote. Do you see that?

18 A I do.

19 Q Why did you choose Yamada as a secondary  
20 reference for Anzai, to support Anzai's disclosure,  
21 if they teach identical layers?

22 A Well, but they don't --

23 MR. LONEY: Object to form.

24 THE DEPONENT: I'm sorry.

25 MR. LONEY: Go ahead.

1 THE DEPONENT: They use the same layer  
2 numberings, but it doesn't -- as I've stated right  
3 there, there is an express teaching in Yamada  
4 concerning the composition of 19. So in Yamada,  
5 let's see, pointed to column 6, for instance, in  
6 Yamada.

7 So if I go to column 6, at line -- yes, it is  
8 48 through 50. It -- or 50 -- that cite -- I'm just  
9 looking at the cite. Now, I think it's line --  
10 column 6, yes. No, it is 48 to 50. I'm sorry.

11 It's talking about 19 in -- sorry. In Anzai  
12 -- in Anzai -- you know, Anzai, it simply describes  
13 19 as a planar -- I believe it refers to it as a  
14 planarization and gives an example material, which  
15 was a poly -- I don't know whether it was a polymer  
16 layer. It was -- it was -- let's see. 19. There it  
17 is. And Anzai 19 was -- excuse me. So that was  
18 Exhibit 2.

19 And we discussed this earlier. 19 is called  
20 the planarizing film. There is another spot where  
21 it, I think, identifies -- let me find it.

22 It identifies film 17 made of an organic  
23 resin. Then 19 -- other than calling it a second  
24 planarization film, I don't believe it even  
25 identifies -- says specifically what material you

1 might select for 19. That's different in Yamada.

2 Yamada is explicit as to choices for that material.

3 BY MR. CUMMINGS:

4 Q But the structure is the same?

5 A Well, they both have layer 19, I believe, in  
6 the same location. So in -- let's see. Where is the  
7 Yamada number.

8 So if you look at Yamada -- let me get my  
9 copy of Yamada. Anzai. Here is Yamada.

10 So Yamada has not exactly the same plan view  
11 but a very similar one. Yamada has, for instance, at  
12 Figure 4A, so the cross-sections are similar but are  
13 not -- for instance, I believe 4A is only -- maybe  
14 partway through, you see layer 19, which you also see  
15 in Anzai; and below that, you see layer 17, which you  
16 also see in Anzai, labeled with the same numbers.

17 So if you compare the cross-section in Anzai  
18 at Figure -- I'm trying to find what's a -- a fairly  
19 comparable one.

20 The cross-sections -- some of the  
21 cross-sections are done in different locations in  
22 Yamazaki than they are in Anzai, but one place to  
23 compare would be to look at Figure 4A or 4 -- and 4B  
24 of -- gosh. Sorry. Of Yamada.

25 And for instance, look at Figure 2A of Anzai.

1 You'll see layer 19. You'll see layer 17. You see a  
2 very similar layer stack-up.

3 Q Looking at Figure 4B of Yamada, can you walk  
4 me through the fabrication process of how this  
5 structure would be made?

6 A I --

7 MR. LONEY: Objection. Form.

8 THE DEPONENT: I -- I could walk through  
9 the -- the films there, and let me -- so for Yamada,  
10 presumably, one way to do this would be to start with  
11 10. 10 in Yamada is called the "A" substrate.  
12 Beyond that -- if you'll excuse me just a moment,  
13 I'll try to split my screen to make this a little bit  
14 easier.

15 So you asked me to walk through Figure 4B of  
16 Yamada; is that correct?

17 BY MR. CUMMINGS:

18 Q Yes.

19 A Okay. So I've just simply split my screen so  
20 I can see the figure I want to, and I can also see  
21 the text at the same time.

22 So I'm starting in column 1 of Yamada.  
23 Around line 29 or 30, it identifies the substrate 10.  
24 When I look at Figure 4B, I would, just from that,  
25 expect that probably the next film would be where

1 that "43" points.

2 Now, that discussion is about Figure 2. So  
3 let me see if I can find something that is more  
4 specific to Figure 4.

5 A lot of the discussion in Yamada starts at  
6 column 5, but the beginning of it is really about 4A;  
7 and talking about the transistor, I'll call it 33.  
8 You're asking about 40B -- I mean Figure 4B. Excuse  
9 me.

10 Ah. There it is. Okay. So column 6, lines  
11 7 and following, there is an active layer 43. It  
12 even tells you what it's formed by -- what it's  
13 formed of, alpha -- amorphous silicon in the  
14 recrystallization step.

15 So there would be -- on 10, I would expect  
16 there to be a deposition, a blanket deposition of  
17 this amorphous silicon recrystallization as stated in  
18 column 6. That would then be followed by a  
19 lithography-and-etch step to pattern -- to reach the  
20 desired pattern, in active layer 43.

21 Then the next film -- and in Yamada, I  
22 believe it does use the word "layer."

23 The next one is the gate-insulating film.  
24 Yamada refers to it as 32. You see that as a blanket  
25 film. It would cover everything. Probably no

1 lithography and etch in that layer yet.

2 The next deposition would be a material  
3 blanket film to form gate electrodes 41. That would  
4 require lithography and etch step to produce the  
5 desired pattern.

6 Next would be an interlayer insulating film  
7 15. That's a quote from Yamada starting at line 15  
8 in column 6.

9 15 would then require a lithography and etch  
10 step to open contact hole or via, down through 15 and  
11 32, reaching 43.

12 It looks like then there would be a blanket  
13 deposition for a layer that's used to form 52. "See  
14 52 in Figure 4B." Let me see if I can find the --  
15 the text description for 52.

16 50 -- 50 -- 52, yes, 52. There it is. So  
17 you have to skip forward to column 7, line 50 --  
18 looks like about 53. It describes 52 as a drive  
19 signal line. So that would require -- likely would  
20 be a blanket deposition of some conductive material,  
21 followed by lithography and etch to form the desired  
22 pattern.

23 Next would be a -- likely would be a blanket  
24 deposition of -- of 17.

25 Q Is 17 formed on 32?

1           A    17 -- in Figure 4B, 17 is formed on 15 in  
2   Figure 4B.

3           Q    Okay. I see.

4           A    All right. At that point, looking at Figure  
5   4B's cross-section, I would expect there would be a  
6   lithography and etch process to open a via that goes  
7   through 17, through 15, through 12, to touch 43.

8                   Then there would be a, most likely, blanket  
9   film deposition for 61, which I think is back in  
10   column -- 61 is identified as being the anode, but  
11   that is clearly something that has to be deposited  
12   and lithography and etched to produce the desired  
13   pattern.

14                   And it also -- I don't know whether it  
15   specifies that the filling of the via is done with  
16   the same material as 19. That is a way to do it. I  
17   don't recall whether Yamada bothers to say.

18                   Next would be the blanket deposition, most  
19   likely, of 19 and a lithography and etch process to  
20   open a window in that.

21                   Next would be blanket deposition 62 -- for  
22   layer 62, 63; and although in Figure 4B you can't  
23   tell whether it's patterned or not, requiring  
24   lithography and etch.

25                   It wouldn't surprise me if it is. I don't

1 know whether that's illustrated in the complete plan  
2 view or not.

3 Q Is 63 formed on 19?

4 MR. LONEY: Objection. Form.

5 THE DEPONENT: As shown in Figure B, 63 -- in  
6 Figure B, it's shown on 62. 62 is on 19. So 63 and  
7 62, if we go -- let me find the Figure 4B. 62, 63.  
8 Let me find it.

9 19. I'm still trying to find the text that  
10 corresponds to 62, 63 and 64.

11 So it describes 66, which it indicates is a  
12 com -- looks like it's a combination of 65, 64, 63.  
13 It refers to that as the emissive layer.

14 It does that first, I guess, in maybe column  
15 6 at line 59, 60. It -- it refers to it at --  
16 several times. 66 as being the emissive element  
17 layer.

18 Still trying to find whether it goes through  
19 -- there it is.

20 Column 7. I'll start at line 30. It's  
21 saying that the emissive element layer comprises  
22 first-hole transport layer 62.

23 So we see 62 in Figure 4B and, as illustrated  
24 there, 62 is on 19.

25 Following 62 is a second-hole transport layer

1 63, and following that is an emissive layer 64. We  
2 can clearly see that 64 is patterned, so there is a  
3 lithography and etch step to produce the desired  
4 pattern.

5 Next, there would be a blanket deposition of  
6 65, which is described as an electron transport layer  
7 in column 7 at line 35, 36.

8 Here in this cross-section, I can't tell  
9 whether that has a pattern or not. Again, it  
10 wouldn't surprise me if it does. So there may be a  
11 lithography and etch step.

12 And then finally, there is layers -- or 67,  
13 which is called out at line 37 in column 7, as the  
14 cathode.

15 Again, in Figure 4B, I can't tell whether  
16 it's patterned, so I don't know from Figure 4B  
17 whether there is a lithography and etch step, but it  
18 wouldn't surprise me if there was.

19 BY MR. CUMMINGS:

20 Q And is 67 formed on 64?

21 MR. LONEY: Objection. Form.

22 THE DEPONENT: In this figure -- so 67 is  
23 formed on 64 because -- well, formed is -- so I want  
24 to be careful. Formed is, like, layer, or over.

25 In the claims of the '477, "forming" is used

1 repetitively throughout the claim language, and of  
2 course there is always a question as to whether you  
3 mean directly formed on or simply formed on.

4 67 is directly formed on 65. But  
5 nonetheless, 67 is formed on 60 -- what is it? It's  
6 on 64. It's formed on 63. There is an intervening  
7 layer, but I don't believe that the patent specifies  
8 that if it simply says "formed," it means formed  
9 directly on.

10 So all of these layers are formed on the  
11 layers below. Some of them are formed directly on,  
12 and that's a more -- a narrower statement.

13 MR. CUMMINGS: All right. Well, thank you,  
14 Dr. Neikirk, that is all I have for the '477 patent,  
15 so I will turn it over to Mr. Loney.

16 MR. LONEY: Let's go off the record, take a  
17 quick break while I check my notes.

18 THE VIDEOGRAPHER: Okay.

19 MR. LONEY: I will have a few questions.

20 THE DEPONENT: How -- how long? I'm sorry.  
21 Are we off the record? Excuse me.

22 THE VIDEOGRAPHER: Off the video record at  
23 2:11 p.m.

24 (Off the record.)

25 THE VIDEOGRAPHER: On the video record at

1 2:26 p.m.

2 EXAMINATION

3 BY MR. LONEY:

4 Q Welcome back, Dr. Neikirk. I just have a few  
5 questions for you. Do you recall earlier today when  
6 you were discussing the '121 patent and discussing  
7 your combination of Yamazaki with Anzai?

8 A Yes, I do.

9 Q All right. And do you also recall that you  
10 referred to Figure 15A on page 61 of your  
11 declaration?

12 A Yes, I do recall that discussion.

13 Q And in light of 15A on page 61, can you  
14 explain your opinions regarding the combination of  
15 Yamazaki with Anzai?

16 A Well, I -- so -- and I think I mentioned that  
17 -- that Yamazaki had an embodiment with multiple  
18 dielectric layers in a specific place.

19 If -- if -- I think in paragraph 15 there on  
20 page 61, I specifically mention that there is an  
21 additional insulation layer that's formed under the  
22 insulation layer 1430. So 1431 in Figure 15A is  
23 under 1430.

24 So I think that was -- I -- I think I tried  
25 to indicate that, but I may not have called out the

1 layers, but we see 1431 there in that figure, and  
2 it's under -- it's formed under 1430 there.

3 MR. LONEY: Thank you. No more questions.

4 THE VIDEOGRAPHER: Okay. Is everyone ready  
5 to conclude the deposition?

6 MR. LONEY: Yes.

7 MR. CUMMINGS: Yes.

8 THE VIDEOGRAPHER: All right. This concludes  
9 the deposition of Dr. Dean Neikirk on April 17, 2025.  
10 Off the video record at 2:28 p.m.

11 (Off the record.)  
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## ACKNOWLEDGMENT OF DEPONENT

I, DEAN NEIKIRK, 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.

---

DEAN NEIKIRK, PH.D.

---

(DATE)

## 1 E R R A T A S H E E T

2 DEPONENT: DEAN NEIKIRK, PH.D.

3 CASE NO.: 37-2023-00026501-CU-OR-NC

4 United States Patent and Trademark Office

5 STENOGRAPHER: Theresa Williamson, CA CSR No. 14545

6 DATE TAKEN: April 17, 2025

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## 1 REPORTER'S CERTIFICATE

2 I, THERESA WILLIAMSON, RPR, RMR, CRR, CA CSR NO. 14545,  
3 DO HEREBY CERTIFY THAT THE FOREGOING DEPOSITION OF DEAN  
4 NEIKIRK, PH.D., WAS TAKEN ON APRIL 17, 2025 VIA ZOOM  
5 CONFERENCE BEFORE ME AT 10:02 A.M. FOR THE PURPOSE IN THE  
6 CAPTION STATED; THAT THE WITNESS WAS FIRST DULY SWORN TO  
7 TELL THE TRUTH, THE WHOLE TRUTH, AND NOTHING BUT THE TRUTH;  
8 THAT THE DEPOSITION WAS TAKEN BEFORE ME STENOGRAPHICALLY  
9 AND AFTERWARDS TRANSCRIBED UNDER MY DIRECTION; THAT THE  
10 FOREGOING IS A FULL, TRUE, AND CORRECT TRANSCRIPT OF THE  
11 SAID DEPOSITION SO GIVEN; THAT COUNSEL FOR ALL PARTIES WERE  
12 PRESENT AT THE TIME OF THE DEPOSITION; THAT THERE WAS A  
13 REQUEST THAT THE WITNESS READ AND SIGN THE TRANSCRIPT.  
14 I FURTHER CERTIFY THAT I AM NEITHER OF COUNSEL NOR  
15 OF KIN TO ANY OF THE PARTIES TO THIS ACTION, AND AM IN  
16 NO WAY INTERESTED IN THE OUTCOME OF SAID ACTION.

17  
18  
19 WITNESS MY SIGNATURE ON APRIL 23, 2025.  
20  
21  
22

23 *Theresa Williamson*  
24

25 THERESA WILLIAMSON,  
RPR, RMR, CRR, CA CSR NO. 14545

|                                                                                                                         |                                                |                                                                                                                                                                        |                                                                                                                                                                                                                                               |                                                                                     |
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