

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

PICTIVA DISPLAYS)
INTERNATIONAL, LTD.,)
)
Plaintiff,) Civil Action Nos.:
) 2:23-cv-00495-JRG
vs.)
)
SAMSUNG ELECTRONICS CO.,)
LTD., SAMSUNG ELECTRONICS)
AMERICA, INC.,)
)
Defendants.)
-----)

HIGHLY CONFIDENTIAL

VIDEOTAPED VIDEOCONFERENCE DEPOSITION OF:
HOMER ANTONIADIS, PhD
WEDNESDAY, JUNE 4, 2025

Reported by: Monice K. Campbell, CRR, RMR,
NV CCR No. 312, CA CSR No. 14171
Job No.: SD 7353095

1 VIDEOCONFERENCE DEPOSITION OF HOMER ANTONIADIS, PhD,
2 held remotely, on Wednesday, June 4, 2025, at 9:18
3 a.m., before Monice K. Campbell, Certified Court
4 Reporter, in and for the State of California.

5
6 APPEARANCES:

7 For the Plaintiffs:

8 IRELL & MANELLA LLP

BY: HONG (ANNITA) ZHONG, ESQ.

9 1800 Avenue of the Stars, Suite 900

Los Angeles, California 90067

10 (310) 277-1010

hzhong@irell.com

11
12 For the Defendants:

13 QUINN EMANUEL URQUHART &

SULLIVAN, LLP

14 BY: LANCE YANG, ESQ.

1109 First Avenue, Suite 210

15 Seattle, Washington 98101

(206) 905-7000

16 lanceyang@quinnemanuel.com

17 Also Present:

18 DAVID WEST, VIDEOGRAPHER
19
20
21
22
23
24
25

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

I N D E X

HOMER ANTONIADIS, PHD	PAGE
Examination By Ms. Zhong	6

E X H I B I T S

NUMBER	DESCRIPTION	PAGE
Exhibit 1-A	Curriculum Vitae	78
Exhibit 1-B	Materials Considered	78
Exhibit 2	U.S. Patent 7,321,193	71
Exhibit 3	Work Report, [REDACTED] SDC_00076984 through SDC_00077057	100
Exhibit 4	Emerging Display Technology Trend & Market Forecast, SDC_00075653 through SDC_00075692	104
Exhibit 5	Final Technical Progress Report	116
Exhibit 6	Presentation by Kateeva, Inkjet Technology for OLED SSL Mass Production	132
Exhibit 7	Samsung Display Document, SDC_00076087 through SDC_00076092	148
Exhibit 8	Invention Disclosures in IPR2024-01222	182

* * * * *

WEDNESDAY, JUNE 4, 2025

9:18 A.M.

* * * * *

THE VIDEOGRAPHER: Good morning. We 09:18
are on record. The time is 9:18 a.m. Pacific
Daylight Time. The date today is June 4th,
2025. Please note that this deposition is being
conducted virtually. The quality of recording
depends on the quality of the camera and 09:18
internet connection of participants. What is
seen from the witness and heard on screen is
what will be recorded. Audio and video
recording will continue to take place unless all
parties agree to go off the record. 09:18

This is Media Unit 1 of the
video-recorded deposition of Homer Antoniadis,
PhD, taken by counsel for plaintiffs in the
matter of Pictiva Displays International
Limited, et al., versus Samsung Electronics 09:18
Company, Limited, et al., filed in the United
States District Court for the Eastern District
of Texas, Marshall Division. The case number
is 2:24-CV-00532-JRG.

The deposition is being conducted 09:19

1 remotely using virtual technology. 09:19
2 My name is David West representing
3 Veritext Legal Solutions, and I am the
4 videographer. I am not related to any party in
5 this action nor am I financially interested in 09:19
6 the outcome. If there are any objections to
7 proceeding, please state them at the time of
8 your appearance.
9 Counsel will now state their
10 appearances and affiliations for the record 09:19
11 beginning with the noticing attorney.
12 MS. ZHONG: Annita Zhong with Irell &
13 Manella representing the plaintiffs.
14 MR. YANG: Lance Yang, Quinn Emanuel,
15 on behalf of the defendants and the deponent. 09:19
16 THE VIDEOGRAPHER: Thank you.
17 Will the court reporter please
18 introduce yourself and administer the oath to
19 the witness, and then counsel may proceed.
20 THE COURT REPORTER: Good morning. 09:19
21 My name is Monice Campbell. I'm certified court
22 reporter number 14171 in the State of California.
23 Whereupon,
24 HOMER ANTONIADIS, PhD,
25 having been sworn to testify to the truth, the 09:20

1 whole truth, and nothing but the truth, was 09:20
2 examined and testified under oath as follows:

3 THE VIDEOGRAPHER: Counsel, you may
4 proceed.

5 EXAMINATION 09:20
6 BY MS. ZHONG:

7 Q. Good morning, sir. Can you please
8 state your name for the record?

9 A. My name is Homer Antoniadis.

10 Q. Sir, you have been retained by 09:20
11 Samsung; is that correct?

12 A. That's correct.

13 Q. When were you first retained?

14 A. I've been retained a few months back
15 by Quinn Emanuel on behalf of Samsung. 09:20

16 Q. Do you recall when exactly that
17 happened?

18 A. I don't remember exactly for this
19 particular case, but I believe -- I shouldn't
20 say few months. It's almost a year now. Last 09:20
21 spring or so. I don't remember the exact date.

22 Q. So you were retained in 2024?

23 A. I was retained in 2024, that's right.

24 Q. Okay. Were you first retained as a
25 fact witness? 09:21

1 A. I don't know this. I was retained as 09:21
2 a consultant to help them in general about OLED
3 technology and the landscape in general and also
4 get familiar with the case.

5 MS. ZHONG: Court Reporter, I'm 09:21
6 putting in some jargon words in the chat box so
7 you have them.

8 BY MS. ZHONG:

9 Q. You said that you were retained to
10 help Samsung in general about OLED technology 09:21
11 and the landscape in general. What do you mean
12 by the "landscape in general"?

13 MR. YANG: I caution the witness not
14 to reveal any communications or work you've done
15 on behalf of Samsung for this case, but I will 09:22
16 permit you to respond at a high level in
17 generalities.

18 THE WITNESS: One of my tasks was to
19 review at high level the Pictiva patents and get
20 familiar with the Pictiva patents so I can 09:22
21 better calibrate myself.

22 BY MS. ZHONG:

23 Q. Okay. So which Pictiva patents did
24 you review?

25 A. I have reviewed -- I don't remember 09:22

1 the exact numbers, but I believe I have read 09:22
2 generally all the patents under litigation here.

3 Q. And by "Pictiva patents," those were
4 originally assigned to Osram, correct?

5 A. I believe so. 09:23

6 Q. Okay. And Pictiva was actually a
7 trademark for the OLED displays manufactured by
8 Osram; is that correct?

9 MR. YANG: Hold on. Let her finish
10 asking her question before you respond. And let 09:23
11 me -- give me a chance to object.

12 So I have an objection to that
13 question.

14 But you can go ahead and respond.

15 THE WITNESS: Yes. The answer is yes 09:23
16 to your question.

17 BY MS. ZHONG:

18 Q. So Osram manufactured OLED displays
19 at one point; is that correct?

20 A. That's correct. 09:23

21 Q. And what approach did Osram take
22 to -- to its OLED displays, technologywise?

23 MR. YANG: Objection.

24 THE WITNESS: Osram worked on OLED
25 displays while I was employed by Osram between 09:24

1 2000 and 2005. Maybe a little bit after that, I 09:24
2 left.

3 BY MS. ZHONG:

4 Q. Do you know when Osram first
5 started -- strike that. 09:24

6 Do you know when Osram first started
7 to be involved in OLED display technology?

8 A. I don't know the exact date.

9 Q. Do you know which year?

10 A. I started my employment January 2000. 09:24
11 It was before that.

12 Q. Was Osram actively engaged in OLED
13 development throughout your employment at Osram?

14 A. Yes.

15 Q. What was your responsibility or role 09:25
16 at Osram?

17 A. I was a member of the product
18 development team. And towards the end, I was
19 one of the executives in the product development
20 community. 09:25

21 Q. So when did you transition from a
22 member of the product development team to the
23 role of being an executive of development?

24 A. Well, I was hired as a product
25 manager, I believe, with more responsibility on 09:25

1 reliability and testing. And after two years in 09:25
2 this role, I was promoted to the head of product
3 development, and I had the worldwide
4 responsibility of developing the Pictiva OLED
5 modules. 09:26

6 Q. Can you please give a little
7 background -- strike that.

8 What was your background in OLED
9 before you joined Osram?

10 A. Essentially, I started my official 09:26
11 work with OLEDs with Hewlett-Packard Labs
12 September '94. I -- also before that, I was at
13 Xerox in University of Rochester when the first
14 time I heard about OLEDs from the actual
15 inventors. So I would say '92 or so, 1992. 09:26

16 So five years with HP Labs. I was a
17 hands-on contributor, individual contributor,
18 and then senior contributor at HP Labs working
19 on both vacuum-deposited OLEDs and soluble
20 OLEDs. So I had a very good understanding of 09:26
21 both types of technologies.

22 Q. Okay. So when you joined Osram, were
23 you still engaged in developing OLEDs?

24 A. Yes. We were part of the development
25 team that was based here in -- first Cupertino 09:27

1 and then in San Jose. 09:27

2 Q. What was some of the -- strike that.

3 Can you give an overview of the
4 research and development activities that Osram
5 undertook in those years? 09:27

6 A. The responsibility that we had as an
7 R&D team here was to develop a 200-millimeter
8 pilot line that will couple with a larger line
9 that Osram had in Penang, Malaysia. The factory
10 in Penang, Malaysia, was larger. It had the 09:27
11 capability of doing mass production, where we
12 had the capability of doing R&D and product
13 design and development.

14 And one important component there is
15 that we were focusing primarily on soluble OLEDs 09:28
16 or otherwise called as light-emitting polymers.

17 Q. What was some of the key development
18 work Osram undertook?

19 A. Osram pioneered the way of coating
20 large surfaces with soluble OLEDs. We became 09:28
21 very good at this in achieving uniform layers by
22 using the so-called spin coating technique, and
23 we focus on primarily on high-quality,
24 monochrome, passive matrix displays having a
25 variety of different colors. 09:29

1 Q. How would you describe the quality of 09:29
2 the work Osram undertook in the OLED field?

3 A. Osram was very focused on -- all
4 along on automotive and enterprise type of
5 applications, so they paid a lot of attention to 09:29
6 delivering quality.

7 So we had to focus on whatever we can
8 do, in this case, passive matrix, OLED displays
9 based on soluble technology that would deliver
10 the color that we advertised, the reliability 09:29
11 that we advertised, and stay very close to the
12 customer.

13 Q. So why did Osram decide to focus on
14 passive matrix OLED and using the soluble
15 technology? 09:29

16 A. The decision was taken before my
17 presence there, so I don't know all the details,
18 but the original fundamental assumption was we
19 believed at the early 2000s that soluble OLEDs
20 will eventually be a lot cheaper than the 09:30
21 vacuum-deposited OLEDs. It's cost primarily and
22 the ability to scale it up in large substrates
23 easier than the vacuum-deposited OLEDs.

24 Q. Did Osram develop a full-color
25 display? 09:30

1 A. Of course it was part of our roadmap, 09:30
2 and we had a Department of Energy program where
3 we developed full -- we developed a concept for
4 using full color towards a full-color gamut
5 lighting solutions. So we used inkjet printing 09:31
6 for this. For light-emitting polymers, the only
7 way to do full color -- which is actually a very
8 attractive way, is to use inkjet printing. So
9 that was the vision all along.

10 Q. You mentioned a DOE project. 09:31

11 A. Department of the Energy, yeah.

12 Q. So you mentioned a project that was
13 the Department of Energy. Can you provide a
14 little more detail on what was the project about
15 and what you meant -- what Osram managed to 09:31
16 achieve?

17 A. Yes. The idea there was to use
18 soluble OLED materials, focus on two paths,
19 build devices that emit white light out of a
20 single layer where all the components of the 09:31
21 OLED materials I included in one layer, so we
22 delivered that.

23 And the second path was to deliver a
24 white-emitting panel by using red, green, and
25 blue stripes that we inkjet printed that appear 09:32

1 to have also white color when you control the 09:32
2 RGB components.

3 It was a substantial program. The
4 DOE contributed 50 percent of the funds and
5 Osram contributed the other half. 09:32

6 Q. Okay. How much funding did you get
7 from the DOE for that project?

8 A. I don't remember the exact -- I
9 remember \$4.6 million and Osram I think 4.6.

10 Q. So a total of about 9.2 million on 09:32
11 the project?

12 A. Yes.

13 Q. How long was the -- sorry. How long
14 was the program?

15 A. That was a three-year program that we 09:32
16 had to terminate, I believe, in the second year.

17 Q. What was the reason for the
18 termination?

19 A. Osram decided to move the facility to
20 Germany. 09:33

21 Q. So it was to be a three-year,
22 9-million-plus project?

23 A. Yes.

24 Q. And Osram terminated it after
25 two years? 09:33

1 Q. Okay. So did that include Germany as 09:34
2 well?

3 A. I had -- for product development, I
4 had the responsibility in Germany and also
5 Penang. There were -- there were a couple of us 09:34
6 in this organization. I had the overall
7 responsibility of the actual module design.
8 That includes the glass, the OLED material, and
9 the electronics.

10 There was a different team that did 09:35
11 all the materials development and the device
12 development. I was not responsible for this.

13 Q. Okay. When you say the "OLED glass,"
14 what are you referring to?

15 A. It's the actual module, the part 09:35
16 number that Osram sold under the name Pictiva.
17 It's basically the part number. What it takes
18 to build this module, the design of the glass,
19 the design of all the masks that go into doing
20 the metalization, the encapsulation, the 09:35
21 flexible tail, and the IC on glass or on flex.

22 Q. And you said there was a separate
23 materials development team and device team.
24 What do they do? What did they do?

25 A. They will manage the relations with 09:36

1 the materials providers. They will work towards 09:36
2 improving the performance of the devices along
3 the lines of light emission, device efficiency,
4 reliability. Different colors have different
5 reliabilities, different vendors have different 09:36
6 colors with different reliabilities. There is a
7 lot to be done when it comes around the OLED
8 materials, per se.

9 Q. Was that group also based in northern
10 California or were they based in -- 09:36

11 A. Yes.

12 Q. -- Germany?

13 A. Yes. Both the materials, device and
14 materials development and the product
15 development R&D groups were based in San Jose, 09:36
16 California.

17 Q. Was that a group led by Frank So?

18 A. Frank So was my lateral colleague.
19 He was managing the materials and device
20 development, and I was managing the product 09:37
21 development.

22 Q. So in addition to the soluble
23 approach, there was another approach, which is
24 the vacuum deposition approach for OLED; is that
25 correct? 09:37

1 A. Can you clarify your question? Are 09:37
2 you referring to Osram or in general about the
3 OLED field?

4 Q. I'm talking with the OLED field in
5 general. 09:38

6 A. Yes, of course. Two major
7 approaches. Soluble OLEDs and vacuum-deposited
8 OLEDs.

9 Q. Okay. The vacuum-deposited OLEDs was
10 first developed at Kodak; is that correct? 09:38

11 A. Yes.

12 Q. And in fact, Samsung licensed Kodak
13 technology when they first added the OLED
14 program; is that correct?

15 A. Yes. 09:38

16 MR. YANG: Objection.

17 But you can go ahead and answer if
18 you know.

19 THE WITNESS: At some point, I
20 remember reading that they had done the 09:38
21 licensing from Kodak. This is public
22 information.

23 BY MS. ZHONG:

24 Q. The soluble OLED technology that
25 Osram uses was developed in-house; is that 09:38

1 correct? 09:39

2 MR. YANG: Objection.

3 THE WITNESS: I don't remember all
4 the details. Part of the technology was
5 developed in-house and part, I believe, was 09:39
6 licensed from outside.

7 BY MS. ZHONG:

8 Q. Do you know who -- which part of the
9 technology was licensed outside?

10 A. The use of the materials -- the type 09:39
11 of materials used was licensed from outside and
12 also some of the fabrication techniques.

13 Q. When you say "the fabrication
14 techniques," which techniques in particular?

15 A. How do you make the module. In other 09:39
16 words, the know-how of how to build this passive
17 matrix displays on glass substrates. How do you
18 encapsulate them, et cetera.

19 Q. And which technologies were developed
20 in-house by Osram team? 09:40

21 A. The integration and the scale up to
22 manufacturing. There was a lot of knowledge in
23 learning how to scale up from small substrates
24 to large substrates.

25 Q. Okay. And you left Osram in 2005, 09:40

1 correct? 09:40

2 A. Yes. The end of September 2005.

3 Q. Okay. And you were not aware of

4 further development in Germany after you left

5 Osram, correct? 09:40

6 A. No.

7 MR. YANG: Hold on a second.

8 Objection.

9 THE WITNESS: I'm not familiar

10 directly from Osram or whatever I could read in 09:40

11 the public domain.

12 BY MS. ZHONG:

13 Q. So you're not aware of their efforts

14 to develop new material technologies in-house,

15 for example, correct? 09:41

16 MR. YANG: Objection.

17 THE WITNESS: I -- I don't know. I

18 don't know this area because I left in October,

19 so I don't know what they were doing after I

20 left with materials. 09:41

21 BY MS. ZHONG:

22 Q. Do you know a gentleman by the name

23 of Karl Pichler or Pichler (pronounced)?

24 A. I know Karl Pichler.

25 Q. What was his background? 09:41

1 A. Both myself and Charlie were hired to 09:43
2 provide high-level OLED expertise. We were the
3 first -- as a matter of fact, I introduced
4 Charlie to Osram. I knew him. I still know
5 him. I'm very close to him. Basically, we were 09:43
6 brought in to help Osram start the R&D program.

7 Q. And you consider him to be an expert
8 in the area of OLED?

9 A. Sorry, I called him Charlie because
10 that his name. Karl Pichler is an expert on 09:43
11 OLEDs, yes.

12 Q. And which area in particular is --
13 strike that.

14 And which area of OLED in particular
15 is he an expert in? 09:43

16 A. I don't know exactly. We parted ways
17 after he left from Osram, and he has done a lot
18 of different activities after that. But I would
19 say that we had similar expertise, both physics
20 background, engineers, understanding how to make 09:44
21 displays.

22 Q. And when did he leave Osram?

23 A. I think he left after two years and
24 joined Nanosolar.

25 Q. So he was at Osram between when and 09:44

1 when? 09:44

2 A. I don't know exactly when he was
3 hired at Osram. Few months after I started, and
4 he left after 20 or 24 months. I started
5 January 2000. 09:44

6 Q. So he was at Osram between spring
7 2000 and --

8 A. Spring 2000. I don't remember the
9 last period, but I remember sitting next to each
10 other in cubicles while we were in Cupertino, 09:45
11 which was spring 2000, correct.

12 Q. And he left in spring 2002?

13 A. I don't remember the year. I think
14 after two years he left, but I need to look it
15 up. I don't remember the date. It probably is 09:45
16 written on his resume or LinkedIn profile, but I
17 don't remember.

18 Q. And did Osram file patents for its --
19 for its work in the OLED field?

20 A. Yes. We were active in filing 09:45
21 patents in the areas that we were working.

22 Q. Was there any particular procedure
23 for filing a patent at Osram in those years?

24 A. We were working with two patent
25 attorneys, but they were residing within our 09:46

1 overall Siemens Osram organization, and they 09:46
2 would encourage us to file invention disclosures
3 as soon as a new idea will come up.

4 And the legal, the two patent
5 attorneys, either one or the other or both of 09:46
6 them, they will meet with the management team to
7 assess the quality of the invention disclosures
8 and decide if, indeed, it's worth going to the
9 next level of, perhaps, patent filing or keep it
10 as a trade secret, et cetera, which is a common 09:46
11 process that I've seen in other corporations,
12 too.

13 Q. Do you recall how long it usually
14 took from submitting an invention disclosure to
15 filing an application? 09:47

16 A. We were in a hurry, so we would push
17 our legal team to examine the disclosures -- the
18 invention disclosures sooner rather than later
19 depending on the importance. And, again, the
20 importance will be judged by the OLED experts 09:47
21 and the senior will trigger the legal team and
22 some will be accelerated out of our own team,
23 this is not through the patent office, or some
24 others will just linger for six months or a
25 year, and some others will be filed within a few 09:47

1 months. I can't remember exactly. 09:47

2 Q. When it's a few months, it's how
3 long? Three months?

4 A. Something like that, yeah.

5 Q. So from invention disclosure to 09:48
6 application, it can range from 2 to 3 months to
7 6 to 12 months?

8 A. Yes.

9 Q. And --

10 A. Roughly speaking. I don't remember 09:48
11 exactly.

12 Q. And were you one of the management
13 team that decides whether to accelerate the
14 filing of an application?

15 A. I was in the committee that we would 09:48
16 meet once a month or sometimes ad hoc to
17 recommend either for a patent filing or to keep
18 it as a trade secret or abandon it as an
19 invention disclosure.

20 Q. So once the invention disclosure was 09:49
21 submitted, there were monthly meetings to
22 evaluate it -- the submitted invention
23 disclosure to see whether you want to proceed
24 with filing or not; is that correct?

25 A. Yeah. The legal team will receive 09:49

1 the invention disclosures, and we would meet in 09:49
2 regular intervals to examine the invention
3 disclosures.

4 Q. And once there is a decision to go
5 forward with the application, the two in-house 09:49
6 patent attorneys will draft the application; is
7 that correct?

8 A. Correct. And, of course, they will
9 get all the input from the inventor or
10 inventors, examples, technical background, and 09:49
11 the like.

12 Q. And once the application was drafted,
13 did the inventors actually review the draft and
14 give the feedback?

15 A. I can only speak about my 09:50
16 applications. They would ask me to make sure
17 that the examples were transcribed properly as
18 well as the description. So we will do one
19 final review, yes. And we will meet.

20 Let's say if it takes a month to 09:50
21 write an application, the inventor will meet
22 with the patent attorney -- we didn't have
23 paralegals -- the patent attorney would draft
24 the application jointly in a sense, and
25 construct, of course, the claims, the legal team 09:50

1 will do that. 09:50

2 Q. Okay. So once the -- once the

3 decision was made to go forward with the

4 invention disclosure, there would be a meeting

5 between the patent attorney and the inventor 09:51

6 before patenting; is that correct?

7 MR. YANG: Objection.

8 THE WITNESS: Yes. Not always, but

9 most of the times.

10 BY MS. ZHONG: 09:51

11 Q. And then after that, the patent

12 attorney would draft the application?

13 A. Yes.

14 Q. And then the inventor would give kind

15 of approval before the application got filed. 09:51

16 Was that correct?

17 A. Well, I mean --

18 MR. YANG: Objection.

19 Go ahead.

20 THE WITNESS: Provide information, I 09:51

21 would say, the correct word. If something has

22 not been transcribed properly, if the examples

23 have inaccuracies, et cetera. "Approval" is not

24 the right word. It's just a consent that

25 everything has been described as presented in 09:51

1 the invention, with some corrections, of course. 09:52

2 BY MS. ZHONG:

3 Q. So once the -- once the attorney
4 drafted the application, the inventors would
5 review it and provide feedback; is that correct? 09:52

6 A. Yes. In most cases.

7 Q. Okay. And did the inventors have to
8 sign declarations before the patent gets filed?

9 MR. YANG: Objection.

10 THE WITNESS: I don't remember that. 09:52
11 I vaguely remember that we had to sign
12 something.

13 BY MS. ZHONG:

14 Q. Okay. And who are the people who
15 decided whether to accelerate an application or 09:52
16 not?

17 A. It was an acceleration recommendation
18 from the management team to prioritize -- let's
19 say we have five cases. We would rate them and
20 we'll say this one is more important than the 09:53
21 other four. Can you work on it first, please.

22 Q. And who were the members of the
23 management team?

24 A. I remember participating in some of
25 them. I don't remember everybody in the team. 09:53

1 But I would say the R&D team would consist of 09:53
2 two or three people. It would vary. Some
3 people would be in Penang, some people would be
4 in San Jose. Whoever was in San Jose.

5 Q. Have you always been on the 09:53
6 committee?

7 A. I have not participated in all. I
8 have been in the committee, but I was not always
9 present because I was traveling quite a lot.

10 Q. So on the invention disclosure, 09:54
11 besides the signature of the inventor, there was
12 also a requirement for someone to witness the
13 invention disclosure; is that correct?

14 A. I believe so. This is so many years
15 ago. Yes. 09:54

16 Q. Do you recall what was the reason for
17 having someone witness the invention disclosure?

18 A. I don't remember very well, but in
19 general, it's a good practice to have a witness
20 in your laboratory books. So that concept would 09:54
21 also follow, I believe -- I don't know if we had
22 that at Osram, but we had that in different
23 companies to also witness the invention
24 disclosure.

25 Q. Do you recall you were asked to 09:54

1 witness invention disclosures when you were at 09:54
2 Osram?

3 A. I don't remember this very well, but
4 I -- the quick answer that comes to my mind is
5 yes. People will come and ask me if that's a 09:55
6 good idea because I had six-plus years of
7 experience prior to some of the inventors there,
8 prior experience with respect to some of the new
9 hires.

10 Q. So if you had witnessed -- let me 09:55
11 withdraw.

12 So what's the significance of your
13 signing a witness -- signing as a witness to an
14 invention disclosure?

15 MR. YANG: Objection. 09:55

16 THE WITNESS: The tradition of the
17 witness is to describe your invention to a third
18 party and make sure that the third party
19 understands your invention. As far as I know,
20 that's the process. 09:56

21 BY MS. ZHONG:

22 Q. So what was your role as a witness to
23 the invention disclosure?

24 MR. YANG: Objection.

25 THE WITNESS: As a witness, I would 09:56

1 just state if I understand the disclosure or 09:56
2 not.

3 BY MS. ZHONG:

4 Q. Okay. So when you sign an invention
5 disclosure, you would have reviewed it first 09:56
6 before signing it; is that correct?

7 A. Of course, I would have asked the
8 inventor to describe it to me to make sure what
9 the invention is or the invention proposal, I
10 should say is, yeah. 09:56

11 Q. Do you recall working with a
12 gentleman named Kyle Frischknecht?

13 A. Kyle Frischknecht, yes.

14 Q. Yes.

15 A. I hired him at Osram. 09:56

16 Q. Okay. What was his background?

17 A. Kyle worked with me at HP Labs. I
18 had hired him at HP Labs to help me make micro
19 displays. He was a very good guy and I hired
20 him back at Osram. HP Labs was shutting down 09:57
21 this group. Process development, deposition. I
22 do remember his background, mechanical engineer,
23 process engineer.

24 Q. When you say "process engineer," what
25 did process engineers at Osram do? 09:57

1 film encapsulation as part of its OLED program? 09:59

2 A. Osram was manufacturing passive
3 matrix displays with a different technique. We
4 had a different approach in making
5 encapsulation, but part of our R&D, we looked at 09:59
6 all different encapsulation technologies,
7 including thin film encapsulation.

8 Q. Was thin film encapsulation needed
9 for flexible OLED?

10 MR. YANG: Objection. 09:59

11 THE WITNESS: In general, not related
12 to Osram, thin film encapsulation will help
13 flexible display fabrication.

14 BY MS. ZHONG:

15 Q. Why would thin film encapsulation 10:00
16 help the flexible display fabrication?

17 A. The thin film encapsulation by
18 itself, it's a flexible layer. You can bend it.
19 You can roll it. Before thin film
20 encapsulation, the industry used metal can. You 10:00
21 cannot bend it. Or glass. You cannot bend it.

22 All displays today are made -- I
23 would say the majority of them are made
24 flexible. Let's say all those that go in the
25 high-end OLED displays are made with flexible 10:00

1 substrate. So a different encapsulation is 10:00
2 required.

3 Q. Why did the industry move to flexible
4 display?

5 MR. YANG: Objection. 10:00

6 THE WITNESS: I don't know the exact
7 reason. I would imagine because the mobile
8 industry wanted thinner displays, so the thin,
9 flexible substrate will enable that format.

10 BY MS. ZHONG: 10:01

11 Q. Was Osram looking into thin, flexible
12 OLED display as well?

13 A. Not as much as we were looking on the
14 glass. The glass fabrication was our bread and
15 butter. That's what we had in mass production. 10:01
16 Flexible was part of the R&D program. It was a
17 small activity.

18 Q. But it was part of the --

19 A. R&D roadmap.

20 Q. How would you rate Osram's OLED R&D 10:02
21 program against its competitors?

22 MR. YANG: Objection.

23 THE WITNESS: It depends on how you
24 compare it. For the soluble OLEDs, the
25 light-emitting polymers, we had the leading 10:02

1 position. I would say we were the best. But 10:02
2 that cannot be compared with the
3 vacuum-deposited OLEDs because the
4 infrastructure is different. So I cannot
5 compare -- the rest of the world was doing 10:02
6 vacuum-deposited. But between us, Philips,
7 DuPont and others, I think we're the best.

8 BY MS. ZHONG:

9 Q. What was Osram's relationship with
10 Siemens? 10:02

11 A. Osram in those days were the
12 subsidiary of Siemens. Siemens is a
13 conglomerate and Osram was the lighting group
14 under Siemens.

15 Q. Is that why the invention disclosure 10:03
16 was sent to the Siemens' IP department?

17 A. I don't know the answer to this. But
18 you're correct, we were working with Siemens'
19 lawyers, patent lawyers.

20 Q. So the two resident patent lawyers 10:03
21 came from Siemens; is that correct?

22 A. Yes, I think so. But we had common,
23 overlapping interests with Siemens as we were
24 part of Siemens as a company.

25 Q. So when you were at Osram, there was 10:04

1 no activity in developing vacuum deposition -- 10:04
2 deposited OLED devices; is that correct?

3 A. We did most all of the work, I would
4 say, on solid OLEDs.

5 Q. But you don't know whether the German 10:04
6 group once you left started to do vacuum
7 deposition technique for OLEDs?

8 A. I don't really know this, but through
9 public presentations that they were giving, I
10 believe they were referring to vacuum-deposited 10:04
11 OLEDs.

12 Q. And when -- even when you were doing
13 the soluble OLEDs, was some part of the OLED
14 structure deposited using vacuum, for example,
15 the cathodes or the anodes? 10:05

16 A. Yes, you're correct. The cathode in
17 particular was done in the vacuum. Not only by
18 us, by everybody. That was the only way to do
19 it.

20 Q. I thought someone was telling me you 10:05
21 can use inkjet to print the cathodes or the
22 anodes.

23 A. I'm not familiar with -- maybe in
24 various esoteric R&D groups, but I don't believe
25 anyone can do that. 10:05

1 Q. Okay. You don't think that was -- 10:05
2 the technology was there back in 2000 --
3 A. Even today.
4 Q. Even today.
5 A. I don't think so. 10:05
6 THE COURT REPORTER: What was your
7 answer?
8 THE WITNESS: It's not used today,
9 either today. It's not a successful method to
10 print the cathode to my knowledge. 10:05
11 BY MS. ZHONG:
12 Q. Could you have printed, for example,
13 gold metal particles and have it to form a gold
14 cathode?
15 A. Yeah. That's a very scientific 10:06
16 question. I don't know the answer to this. In
17 theory, yes, you could do it, but you need a low
18 work function metal. And when you introduce it
19 into a solution, it tends to react with the
20 solvent and loses its ability to inject 10:06
21 electrons. That's why it's so hard to do it by
22 printing.
23 Q. But I thought for printing,
24 especially for inkjet printing, the solvents
25 will eventually dry out leaving behind the 10:06

1 solids. So... 10:06

2 A. Yes. I agree with you. But that's
3 for the whole transport layer and the
4 electron-transport layer, for example, not for
5 the cathodes. 10:07

6 Q. So as far as you know, nobody has
7 successfully made a cathode using inkjet
8 printing?

9 A. Yes. As far as my knowledge is
10 concerned, I'm not familiar with this approach. 10:07
11 And I don't think anyone has done it. But I'm
12 not 100 percent sure.

13 Q. But it could be an idea, but it was
14 never successfully executed?

15 A. Yes. 10:07

16 Q. So for the thin film encapsulation,
17 do you know how the various layers were
18 deposited?

19 MR. YANG: Objection.

20 Hold on a second. 10:07

21 Objection.

22 THE WITNESS: Are you referring to
23 today's process or historically?

24 BY MS. ZHONG:

25 Q. Let's start with 2000 -- like early 10:08

1 2000. 10:08

2 A. To my knowledge, no one was using
3 thin film encapsulation in manufacturing in
4 2000. I was familiar already from the work that
5 Battelle had done with thin film encapsulation. 10:08
6 The multi-layer organic/inorganic encapsulation
7 was pioneered by Battelle as well as many other
8 companies had access to this technology. And
9 then --

10 Q. Sorry for interrupting you. When you 10:08
11 say "Battelle," are you talking about Pacific
12 Northwest?

13 A. That's correct. The laboratory in
14 Seattle.

15 Q. And why wasn't anyone doing the thin 10:08
16 film encapsulation commercially back then?

17 MR. YANG: Objection.

18 THE WITNESS: The technology -- to my
19 knowledge, the technology was under development
20 during that time. No one was doing thin film 10:09
21 encapsulation. But Battelle was the pioneer in
22 the thin film encapsulation. We all knew it.
23 Already, you can see there's a lot of prior art,
24 actually, at HP Labs also.

25 They proposed a way of putting 10:09

1 organic/inorganic layers, and we can talk about 10:09
2 the details why there's alternating layers, but
3 reducing it to practice in the mass production
4 mode takes development. You need the
5 formulation to be ready as well as the tools. 10:09
6 No one had that set up for a display
7 environment.

8 BY MS. ZHONG:

9 Q. What about in the lab environment?

10 A. I remember people were struggling to 10:09
11 use this technique in the 90s in the laboratory.
12 The technique was notorious for contaminating
13 the chamber and for affecting the performance of
14 the OLED devices. The original work was
15 detrimental to the OLED devices. 10:10

16 Q. When you said "the original work was
17 detrimental to the OLED devices," what do you
18 mean exactly?

19 A. I don't know all the details, but
20 when you deposit the inorganic layers, the 10:10
21 inorganic layers typically are done at elevated
22 temperatures. So if you're not careful with the
23 inorganic layer, you can affect the performance
24 of the OLEDs.

25 Now, the thin film encapsulation 10:10

1 includes also an organic layer. And when you 10:10
2 put the organic layer down, you introduce
3 particles and managing these particles could be
4 an issue.

5 So these are the two different areas 10:11
6 that I recall that at the early stages the
7 industry struggled.

8 Q. How were the organic layers applied
9 back then?

10 MR. YANG: Objection. 10:11

11 THE WITNESS: Many techniques were
12 used and proposed. I recall a spinout company
13 from Vitex had proposed to do it in some kind of
14 enclosed environment in a different chamber side
15 by side using organic chamber. 10:11

16 BY MS. ZHONG:

17 Q. So was inkjet printing proposed for
18 that?

19 A. I don't know. We need to look up the
20 patents by Battelle to see if printing 10:11
21 technologies had been proposed. I don't know.
22 They claimed a lot. There was a lot of filings
23 from the Pacific Northwest laboratory. One of
24 the inventors is called Affinito, and I know
25 that he has claimed a lot of stuff. This is the 10:12

1 early '90s -- so late '90s, which then -- the 10:12
2 technology was licensed to a startup called
3 Vitex.

4 Q. Vitex?

5 A. I don't know exactly when Vitex 10:12
6 started. I would say 2000. So Vitex was
7 working towards developing thin film
8 encapsulation for OLEDs. That were their focus.
9 Battelle proposed the thin film encapsulation
10 for multiple technologies, including OLEDs, but 10:13
11 also for supercapacitors or other flexible
12 substrates. But Vitex focused primarily in
13 developing the Battelle technology for all OLED
14 encapsulation.

15 Q. Was there specific considerations for 10:13
16 using thin film encapsulation for OLED
17 technology --

18 A. Yes.

19 Q. -- versus -- sorry -- versus using it
20 for super capacitors or other applications? 10:13

21 A. I don't remember 100 percent. But if
22 my recollection is correct, what comes to my
23 mind right now is many years ago, Vitex was
24 primarily focused on OLEDs, but I don't know. I
25 think they were focused on OLEDs, but I'm not 10:13

1 100 percent sure. 10:13

2 Q. So what was some of the specific
3 considerations when thin film encapsulation was
4 used for OLEDs versus other applications?

5 A. So as we discussed earlier, two main 10:14
6 considerations: Number one was to protect the
7 OLED from the ambient water and oxygen. And how
8 do you achieve that? You block the water and
9 the oxygen with inorganic layer. But one major
10 problem that you have with OLEDs is the 10:14
11 management of the particles. OLEDs are very
12 thin, so you need to figure out a way if there
13 are some particles in the device to coat them.
14 So in a sense to planarize all this area.

15 So what the original IP had proposed 10:14
16 is to do alternating stack of organic/inorganic
17 to be able to have an impermeable layer. And in
18 the case that it's not totally impermeable, make
19 it tortuous. In other words, slow down the path
20 of water and oxygen, make it take years or more 10:15
21 than that before it affects the cathode and the
22 organic layers.

23 So that's what Vitex was working.
24 They were very public. They gave presentations.
25 I remember some of their presentations in the 10:15

1 public they were talking about all this and the 10:15
2 effects on OLEDs and how they were improving
3 year by year.

4 Q. Do you know when they first started
5 doing the deposition, were they doing it on a 10:15
6 large substrate with multiple display panels or
7 they were just doing proof of concept ones on a
8 smaller substrate, like one display panel at a
9 time?

10 MR. YANG: Objection. 10:15

11 THE WITNESS: I don't remember very
12 well. What comes to my mind is that they had a
13 tool -- I remember hearing about it -- that
14 would focus on 200-millimeter substrate. But I
15 think they also had examples in coupons, small 10:16
16 substrates, I mean, by coupons.

17 BY MS. ZHONG:

18 Q. As part of the soluble OLED
19 development -- strike that.

20 So as part of Osram's effort to 10:16
21 develop soluble OLED, did it also develop
22 inkjet printing technology?

23 MR. YANG: Objection.

24 THE WITNESS: As we have publicized
25 in the Department of Energy report, we had 10:17

1 purchased an inkjet printer to build this OLED 10:17
2 lightings. It was part of the Department of
3 Energy program. So we were looking into inkjet
4 printing. Developing, I should say.

5 BY MS. ZHONG: 10:17

6 Q. And what were some of the efforts in
7 developing an inkjet printing technology?

8 A. It's a multidimensional task, rather
9 complex task. For instance, developing the
10 inks, the red, green -- the displays consist of 10:17
11 red, green and blue inks. Those that are used
12 for spin coating have a viscosity that is
13 different than the viscosity that is required
14 for inkjet printing, so the modifications need
15 to take place. 10:18

16 So we will work with external
17 materials, vendors, to modify the viscoelastic
18 behavior of the inks so we can form the -- the
19 droplet formation is another thing that is
20 directly related with the rheological or the 10:18
21 viscoelastic properties of the inks.

22 So a lot of the work went there.
23 Then at the same time, because they had
24 technology, per se, it was not developed fully,
25 we had to work with different head technologies 10:18

1 and evaluate the head technologies. It's very 10:18
2 similar to the inkjet printer that we use today
3 for printing paper, but paper is passive where
4 the printed OLED is active.

5 So you want to make sure that you 10:18
6 land it on the right location and you don't have
7 misprints and misfires. Of course, the
8 Department of Energy program didn't care so much
9 about manufacturability. We cared about pulling
10 together a demo that would demonstrate a 10:19
11 lighting source that consists of RGB stripes.
12 So we had to work -- and it's -- we describe a
13 lot of the stuff in the public report. It's all
14 written there, what we had done.

15 Q. Did you have to do kind of 10:19
16 preliminary work to establish the capability and
17 viability of the approach before you applied for
18 the grants from DOE?

19 MR. YANG: Objection.

20 THE WITNESS: I don't understand the 10:19
21 question. Can you repeat it, please?

22 BY MS. ZHONG:

23 Q. Sure. A lot of times when you apply
24 for government funding, you have to demonstrate
25 to the government that the idea you propose was 10:20

1 actually going to work somehow, right? So 10:20
2 usually a lot of times the companies or
3 universities will actually have done some
4 preliminary work already, for a year, like 6
5 months to 18 months, to demonstrate that 10:20
6 actually this is what I have done so far. And
7 based on what I have seen so far, I think
8 whatever I'm proposing has a chance of working,
9 right? Did that happen with Osram?

10 A. I agree with you. Yes. It took us 10:20
11 two years to convince DOE to give us the money.

12 Q. So if my counting is correct, so the
13 DOE program started in 2003, correct?

14 A. I don't remember exactly. Around
15 that time, yes, two years. Around that time, 10:20
16 correct.

17 Q. And you had to -- so before --
18 two years before that, like, Osram spent at
19 least two years -- another two years before that
20 in order to demonstrate to the DOE that the 10:21
21 concept is workable, correct?

22 A. Yes. DOE wanted to see the line was
23 working. They fund us for developing the
24 product, not the line.

25 Q. Okay. So between at least 2001 and 10:21

1 2003, Osram was actually working on the pilot 10:21
2 line to demonstrate the feasibility of the
3 manufacturing process?

4 A. Yes. We were working exclusively on
5 displays, passive matrix displays. 10:21

6 Q. Okay. So between 2001 and 2003,
7 Osram was working exclusively on passive matrix
8 OLED displays using soluble technologies?

9 A. The group in San Jose, which I was
10 part of, I would say from January 2000 to 2003 10:22
11 before the DOE come, was working exclusively in
12 developing passive monochrome -- passive matrix
13 displays on 200-millimeter substrates, yes.

14 Q. And the DOE program was to expand
15 that monochrome OLED display to full-color 10:22
16 display?

17 A. No. The proposal was to use this
18 infrastructure to build lighting sources, not
19 passive matrix displays, pixelated displays, but
20 use the technology, the know-how to explore the 10:22
21 opportunity for building light-emitting polymer
22 lighting panels, not displays.

23 Q. Then I thought you said part of the
24 DOE program was also trying to build a
25 full-color OLED. 10:23

1 A. Yeah. From the lighting point of 10:23
2 view, you can generate white light by combining
3 red, green, and blue stripes. As a matter of
4 fact, you can have light of different hues,
5 different whites. That's what we had proposed. 10:23

6 One proposal was to do plain white,
7 white light emitting. The other proposal was to
8 combine RGB stripes for generating an apparent
9 white light source.

10 Q. So what's the difference of 10:23
11 developing an OLED display versus an OLED
12 lighting source?

13 A. So the display consists of pixels,
14 and the pixels typically are very small. And
15 the size of the pixels is directly related to 10:24
16 the density of information that you convey with
17 the displays.

18 For the lighting, you have a lot more
19 freedom in the pixilation. As a matter of fact,
20 you don't need -- in most cases, you don't need 10:24
21 pixilation. It's a single source. You use
22 pixilation as a way of building a more robust
23 lighting source. Or if you want to build it by
24 using the red, green, and blue components, there
25 you have to effectively build pixilation. 10:24

1 But the work that goes into making 10:24
2 pixelated displays, it's a lot -- a lot more
3 elaborate than making lighting sources.

4 Q. So can the full-color RGB technology
5 be applied to full-color display tech? 10:25

6 MR. YANG: Objection.

7 THE WITNESS: In theory, to some
8 degree, yes, but when you go into manufacturing,
9 you realize -- and I know this because of my
10 background -- it's very far. As a matter of 10:25
11 fact, inkjet printing has not been used for
12 lighting at all. And it's never been developed
13 enough for lighting.

14 BY MS. ZHONG:

15 Q. But inkjet printing has been 10:25
16 developed for display technology?

17 A. Displays, yes.

18 Q. But I thought for the DOE program you
19 were developing inkjet printing technology for
20 the OLEDs, correct? 10:25

21 A. Yes. We had a dual effort. DOE
22 wanted to see if RGB can yield higher-power
23 displays. When you separate the emission of the
24 red, green, blue, the resultant power efficiency
25 it's, in theory, higher. But you have the 10:26

1 challenge of controlling the components. 10:26

2 When you do a white-emitting source
3 all blended together, you are running the risk
4 of delivering lower-power efficiency. So DOE
5 was interested to know the difference between 10:26
6 those two technologies. And this is a program,
7 by the way, they have also supported for the
8 inorganic LEDs.

9 But it's expensive and not practical
10 to use RGB both LED or OLED for general 10:26
11 lighting, and that's why it's not used today,
12 right?

13 So that was the reason the DOE
14 supported this program. For us, we had a dual
15 purpose. We wanted to do that as a lighting 10:26
16 company, but also we wanted to see how hard it
17 is to use RGB inkjet printing for full-color
18 passive matrix displays.

19 Q. So part of the DOE program was also
20 trying to see the feasibility of developing a 10:27
21 full-color RGB-based display; is that correct?

22 MR. YANG: Objection.

23 THE WITNESS: Yes. Main purpose of
24 the program was lighting applications, but the
25 lighting work that we did allows to evaluate the 10:27

1 maturity of inkjet printing also for displays. 10:27

2 MS. ZHONG: We've been going for a
3 bit over an hour now. Do you want to take a
4 break or do you want to continue?

5 MR. YANG: We can take a break, yes. 10:27

6 THE WITNESS: 10 minutes? 15
7 minutes? Whatever.

8 MS. ZHONG: Let's get off the record,
9 then we can discuss.

10 THE VIDEOGRAPHER: Thank you. Off 10:27
11 the record at 10:27 a.m.

12 (Recess.)

13 THE VIDEOGRAPHER: We are back on the
14 record at 10:42 a.m. Go ahead.

15 BY MS. ZHONG: 10:42

16 Q. Welcome back, Doctor. You stated in
17 the last session that one of your tasks when you
18 were retained was to review at high level the
19 Pictiva patents and get familiar with the
20 patents so you can better calibrate yourself. 10:42
21 Do you recall that testimony?

22 A. Yes.

23 Q. What do you mean by "better calibrate
24 yourself"?

25 A. Just to understand what the patents 10:43

1 are proposing, what they're claiming to better 10:43
2 understand what the essence of the patents in
3 the claims are.

4 Q. So did you have an understanding of
5 what the patents are? 10:43

6 A. To some degree. I just wanted to
7 know the field of use, the type of device
8 structures, mostly from the science and
9 engineering point of view. That's what I wanted
10 to focus on primarily. 10:43

11 Q. Did you examine the claims?

12 A. I read the claims. That's not always
13 easy to examine them in detail.

14 Q. And do you know what the claim is
15 about? 10:43

16 A. I know what the patent is about and
17 to some degree the claims. I don't remember
18 everything as recently I have been focusing
19 primarily on my subsequent report.

20 Q. So I understand that. So when did 10:44
21 your focus change from understanding the Pictiva
22 patents to the type of work in your report?

23 MR. YANG: Objection. I'm going to
24 instruct the witness not to answer as it
25 involves privileged communications and work 10:44

1 product. 10:44

2 BY MS. ZHONG:

3 Q. When did you start working on your
4 expert report?

5 MR. YANG: You can answer that 10:44
6 question.

7 THE WITNESS: I don't remember
8 exactly. Four or five months ago. I don't
9 remember exactly. I need to look up the exact
10 date. We had also gap periods. 10:44

11 BY MS. ZHONG:

12 Q. What period?

13 A. A large period where we didn't
14 communicate. I think about three to four months
15 ago I started to look into the -- basically, I 10:45
16 looked into this detailed information that was
17 shared with me by Samsung.

18 Q. So you were first retained in spring
19 2024 last year. So sorry. So you were first
20 retained in spring last year? 10:45

21 A. Yes.

22 Q. And at the time, you reviewed Pictiva
23 patents?

24 A. Yes.

25 Q. And then there was a period of 10:45

1 inactivity where you did not have any contact 10:45
2 with Samsung?

3 A. Yes.

4 Q. Okay. And then three or four months
5 ago you were contacted by Samsung again? 10:45

6 A. Yes.

7 Q. And do you recall that you were
8 scheduled for deposition in March 2025 earlier
9 this year?

10 A. Yes. 10:45

11 Q. Do you remember why the deposition
12 was canceled at the last minute?

13 MR. YANG: Yeah. I don't think
14 this -- I caution you not to reveal any
15 communications you may have had with attorneys. 10:46
16 But to the extent you remember why your
17 deposition was moved on a particular date, you
18 can provide that information if it doesn't
19 involve attorney-client privileged information.

20 THE WITNESS: What I recall it was a 10:46
21 difficult period for me. It was conflicting
22 with a lot of dates. But we were getting ready
23 to do the facts deposition, but we couldn't find
24 the right date. I don't recall very well. I
25 remember that I was not very available at that 10:46

1 time, and I thought it was going to happen, but 10:46
2 it didn't happen but I don't know why it didn't
3 happen.

4 BY MS. ZHONG:

5 Q. Were you available in April for 10:46
6 deposition?

7 MR. YANG: Objection. Again, caution
8 you not to reveal any communications you had
9 with attorneys, but, of course, you can talk
10 about your availability if you were unable -- 10:47
11 unavailable or available.

12 THE WITNESS: I know that we changed
13 a lot of dates, but I don't know why. I was not
14 told why we didn't have the facts deposition.

15 BY MS. ZHONG: 10:47

16 Q. Okay. Were you the person who asked
17 to have the deposition moved or rescheduled?

18 A. I provided certain dates, but I --
19 your side was not available. I was not
20 available. So I don't know exactly how we 10:47
21 decided not to take place.

22 Q. Okay. My understanding was we
23 decided on a date, March 14th.

24 A. I remember.

25 MR. YANG: Hold on a second. Is that 10:47

1 a question? Do you have a question? 10:47

2 MS. ZHONG: Lance, let me -- do you
3 forget the rules for Eastern District of Texas
4 objections again?

5 MR. YANG: No. Did you? 10:48

6 MS. ZHONG: So, like, no speaking
7 objections, please.

8 MR. YANG: The last deposition you
9 defended you actually had quite a bit with the
10 expert that we had to remind you, and you 10:48
11 actually took a break and coached him quite a
12 bit. So yes, I do know the rules. I'm only
13 objecting because there is no pending question.
14 So before he answers, there needs to be a
15 pending question. 10:48

16 BY MS. ZHONG:

17 Q. Now, Doctor, do you understand a
18 deposition date was set for your deposition in
19 March?

20 A. I think so, but then it was not 10:48
21 confirmed 100 percent.

22 Q. It was confirmed.

23 A. But then it didn't take place.

24 Q. Our understanding is that you
25 requested to have the date moved. Like, you 10:48

1 asked to have the deposition rescheduled because 10:49
2 of some last-minute events.

3 A. Yes. I had very narrow or limited
4 availability during the month of April, and it
5 was difficult to find the proper date. That's 10:49
6 what I recall. So we keep changing the date,
7 right? So I don't remember exactly why we
8 postponed it, but I thought it was an
9 availability thing.

10 Q. Okay. So for the March date, were 10:49
11 you the person who asked to have the date -- the
12 confirmed date rescheduled?

13 A. I remember a couple of times I asked
14 the date to change because I had conflicts that
15 I couldn't change. 10:49

16 Q. Okay.

17 A. It was a difficult period for me.
18 Sorry.

19 Q. Did you review each of the asserted
20 patents when Samsung first retained you in 2024? 10:50

21 A. Yes, I've read them.

22 Q. Okay. And do you consider yourself
23 to be an expert in the area of OLED?

24 A. Yes, I do.

25 Q. And you have been engaged in the 10:50

1 field of OLED since 1994? 10:50

2 A. A few years earlier, yes, during my

3 postdoctoral years, '93 or so.

4 Q. So you have had more than 30 years of

5 experience in OLED? 10:50

6 A. Hands on, I would say 15 direct

7 experience and about 10 years remote experience,

8 monitoring the field through -- indirectly.

9 Q. When you say "hands on" you -- you

10 had had, like, 15 direct years of experience, 10:51

11 which are those years? Sorry.

12 A. I would say for sure '94 until 2005.

13 Q. Okay.

14 A. The direct experience continued with

15 Kateeva one year, and then Nanosys two years. 10:51

16 Between 2006 and 2015, I would still stay close

17 with the field and monitor the progress of the

18 field, simply because I spend all this time, I

19 always wanted to go back to the field. The

20 startup company that I worked with, we focused 10:51

21 on solar, but solar was also using substrates,

22 plus substrates and the like. There are a lot

23 of commonalities.

24 When DuPont acquired us, indirectly I

25 would monitor and watch the development of 10:51

1 OLEDS through DuPont because DuPont it was, in 10:52
 2 those days, a major OLED material supplier. So
 3 I would read the reports and talk occasionally
 4 with them. So I stayed in touch with the field
 5 and I would go to conferences and I would 10:52
 6 participate in meetings and things of that sort.

7 Q. So you were deeply involved in the
 8 OLED technology during 2000 to 2005 and then
 9 indirectly monitoring the field between 2006
 10 through 2012? 10:52

11 A. Yeah.

12 Q. Okay.

13 A. In 2016, I would say indirectly.

14 Q. 2016?

15 A. Yes. 10:52

16 Q. So in this action, are you offering
 17 an opinion that any of the Osram or Pictiva
 18 patents are invalid?

19 A. No. My understanding is that today's
 20 session it's directly related to my expert 10:53
 21 opinion in relation to my report.

22 Q. Okay. Are you offering any opinion
 23 regarding the validity of the patents?

24 A. No.

25 Q. Are you offering any opinion 10:53

1 regarding the infringement of the patents? 10:53

2 A. No.

3 Q. And you're not offering any opinion
4 regarding the technical benefits of the patents
5 either, correct? 10:53

6 MR. YANG: Objection.

7 But you can go ahead and answer.

8 THE WITNESS: Not really. I am under
9 the impression that this session, it's related
10 to my expert report in relation to Samsung 10:53
11 innovation aspects.

12 BY MS. ZHONG:

13 Q. Are you familiar with the state of
14 the art in OLED between 2000 and 2012?

15 A. Sorry, can you repeat the question? 10:54
16 The years, please.

17 Q. Okay. Are you familiar with the
18 state of art in OLED for the year 2000 to 2012?

19 A. Yes. In particular, 2000 to 2006, I
20 was 100 percent hands on, so I would monitor 10:54
21 everything that was happening at that time.

22 Q. Do you think you would have been
23 capable of assessing the validity of the Osram
24 patents if you had been asked to do that?

25 A. That's not really my function. I can 10:54

1 describe, perhaps, what the patents are about, 10:54
2 but I can express my opinion, I guess, if the
3 patents are related to certain OLED fields, if
4 they're related to certain activities around the
5 world, but validity/invalidity is not for me to 10:55
6 judge. But I can tell you if I agree or
7 disagree with the topic -- the technical topic
8 behind that.

9 Q. So if you had reviewed an invention
10 disclosure, and you have signed that invention 10:55
11 disclosure, does that mean you have agreed with
12 the inventor that there was something novel in
13 that invention disclosure?

14 MR. YANG: Objection.

15 THE WITNESS: The novelty of the 10:55
16 patent, it's not part of the invention
17 disclosure. All we did with the signature is to
18 highlight that this is worth pursuing in the
19 next step, right? So it's up to the legal
20 decide to on the claims. It's up to the 10:55
21 examiner to decide -- so we didn't have any
22 saying on the claims or the allowance of the
23 application.

24 BY MS. ZHONG:

25 Q. But would Osram pursue an application 10:56

1 if it had known that someone had invented the 10:56
2 same idea before?

3 MR. YANG: Objection.

4 THE WITNESS: If we were aware of any
5 particular example of prior art, we would 10:56
6 present it, and then the legal team will find a
7 way to claim novel and unique nonobvious, I
8 should say, claims despite the prior art. If we
9 think that the field is important, we would
10 still pursue, perhaps, an application. 10:56

11 BY MS. ZHONG:

12 Q. And do you think that Dr. Pichler was
13 familiar with the field of OLED in 2000 or 2002?

14 A. Yes.

15 Q. So if he had said, "I didn't find any 10:57
16 art for this idea that I generated," do you
17 trust his judgment?

18 MR. YANG: Objection.

19 THE WITNESS: I remember that our
20 legal team would ask us not to look at prior 10:57
21 art. So we just submit it, and then the legal
22 team will do the prior art search.

23 BY MS. ZHONG:

24 Q. Okay. But what if Mr. -- Dr. Pichler
25 said that I was not aware of anyone doing what 10:57

1 I'm suggesting here, do you generally trust his 10:57
2 judgment based on his knowledge?

3 MR. YANG: Objection.

4 THE WITNESS: In some cases, we'll
5 argue. In some cases, we'll agree. It depends. 10:57
6 It depends on the case. I will not always
7 agree.

8 BY MS. ZHONG:

9 Q. If you had signed his invention
10 disclosure, does that mean that you agree with 10:58
11 it?

12 MR. YANG: Objection.

13 THE WITNESS: I'm trying to
14 remember -- I remember we had cases where we
15 would still sign but the majority will be okay. 10:58
16 Although you sign, you may not be okay. Maybe
17 ambivalent. You're the one that said I'm not so
18 sure. But it's worth pursuing and see if we can
19 get it. I don't believe we can get it -- or in
20 some cases we'll say, this is a great patent. 10:58
21 I'm not familiar. A great invention, I should
22 say, we should apply for a patent. In some
23 cases, we would get the claims. Some other
24 cases, we will not.

25 I have one example where I was very 10:58

1 excited, but we had to abandon it because the 10:58
2 examiner proposed too many objections. It's
3 very hard to tell. It's difficult to answer
4 these questions, right?

5 BY MS. ZHONG: 10:59

6 Q. Have you ever assessed the validity
7 of a patent?

8 A. I have not done an official report of
9 that sort. But I can express an opinion here if
10 a patent potentially can be challenged. 10:59

11 Q. Do you have any opinion regarding the
12 validity of the Pictiva patents you have
13 reviewed?

14 A. They're very specific. I have a
15 general impression. They're very specific and 10:59
16 very narrow, I would say.

17 Q. When you say "they are very specific
18 and narrow, I would say," what does "they" refer
19 to?

20 A. Well, there are some fundamental idea 10:59
21 in the OLED space covered by companies like UDC,
22 Kodak, Cambridge Display Technology, and the
23 like. These are powerful patents, and the proof
24 of that is the generation of licensing
25 agreements. 11:00

1 For instance, the patent that -- that 11:00
2 Osram licensed for Cambridge Display Technology,
3 it's a powerful patent because they're claiming
4 the use of polymers for OLED devices, right?

5 The patents that come from Universal Display 11:00
6 Corporation and Princeton are very powerful
7 patents. Everybody is licensing them.

8 In this case, I don't find the
9 Pictiva patents to have the same strength. As a
10 matter of fact, I think the strength is weaker. 11:00

11 Q. I'm asking a slightly different
12 question. Do you have an opinion regarding the
13 validity of the Pictiva patents you have
14 reviewed, not the coverage?

15 MR. YANG: Objection. 11:01

16 But you can go ahead and answer.

17 THE WITNESS: Do you mind, it's --
18 with your own words, if you describe the word
19 "validity"?

20 BY MS. ZHONG: 11:01

21 Q. Whether they are novel and obvious.

22 MR. YANG: Same objection.

23 But you can answer.

24 THE WITNESS: I'm approaching -- I
25 mean, we can take one after the other. They are 11:01

1 different. They are very diverse in what 11:01
2 they're claiming.

3 For example, recently I worked in
4 the -- in down conversion. I think -- in the
5 beginning I thought the down-conversion patent 11:02
6 is related to the QD-OLEDs. But I discovered
7 after reading it very carefully that the patent
8 is related to lighting sources to avoid the
9 phosphor rendering a color to the display.

10 I thought that there will claim RGB 11:02
11 down conversion, or more specifically, red and
12 green, but they are not. They're claiming
13 lighting conditions where phosphors are used
14 for down converting the blue light to certain
15 light and the filters are used on the front as 11:02
16 a way of rendering a different color.

17 But it's not directly -- the patents
18 are not teaching how to make QD-OLED devices.
19 They are more related to the lighting
20 application. And furthermore, they are not 11:03
21 claiming quantum dots. The industry today is
22 using quantum dots in mass production. Blue
23 OLEDs are used in conjunction with red and
24 green quantum dots.

25 But the patent doesn't claim this 11:03

1 approach. It's more of a lighting patent for 11:03
2 rendering white light more so than a pixelated
3 display. It's not --

4 BY MS. ZHONG:

5 Q. Can it be applied to QD-OLED? 11:03

6 A. No. Someone skilled in the art
7 cannot read the patent and learn how to make
8 down-converted QD-OLED panels. It's totally
9 not -- it's not related -- I mean, it's not
10 related to the word "down conversion," but it's 11:04
11 not a recipe of how to make QD-OLEDs.

12 Q. The down-conversion layer can be
13 QD-OLEDs -- quantum dots, correct?

14 A. Correct. Today in the industry,
15 quantum dots are used for down conversion, yes. 11:04

16 Q. And back then it was known that a
17 color-changing material can be a quantum dot,
18 correct?

19 A. I think the whole concept of down
20 conversion was proposed in the '90s, and you see 11:04
21 a lot of these claims by Kodak and others. So
22 it's not a new concept.

23 Remember, I wrote a paper for the
24 micro displays where we proposed to use down
25 conversion for full color. Now, what media you 11:04

1 use for down conversion varies. That's why 11:04
2 those days, in the '90s, I remember '99 I used
3 the word "media," color-changing media, and with
4 that we would include organic materials,
5 phosphors, quantum dots, et cetera. 11:05

6 Quantum dots were not really present
7 in the '90s. They were discovered a few years
8 later, as you very well know probably. The
9 chemistry Nobel Prize was given to quantum dots.

10 So I don't think this particular 11:05
11 patent can claim what -- it's not enforceable on
12 the QD-OLEDs based on all this prior art.

13 Q. You understand the claims are defined
14 by -- strike that.

15 You understand a patent is defined by 11:05
16 the claims, correct?

17 MR. YANG: October.

18 THE WITNESS: I don't -- I cannot
19 answer this. I don't know.

20 BY MS. ZHONG: 11:06

21 Q. Do you try to map the claims to
22 accused products?

23 A. No. I haven't done this work. I
24 would read the claims and the bulk of the patent
25 and get familiar with the space in general. In 11:06

1 some of them, I'm an expert more so than others, 11:06
2 but I would not go claim by claim. That was not
3 my job.

4 Q. So you did not review the claims?

5 A. I read the claims. 11:06

6 Q. Did you try to interpret the claims
7 from the perspective of a person of ordinary
8 skill in the art?

9 MR. YANG: Objection.

10 But go ahead. 11:06

11 THE WITNESS: To the best of my
12 ability, I read the claims to get familiar of
13 what they're describing, the devices that they
14 described and the structures that they described
15 and looked at other similar prior art for me to 11:06
16 get familiar with the space, but -- yeah.
17 That's what I did.

18 BY MS. ZHONG:

19 Q. Okay. But you did not compare the
20 properly constructed claims with the accused 11:07
21 products, correct?

22 A. No, I didn't do that.

23 Q. Can you please refresh exhibit share
24 and see whether you see an Exhibit 2, which is
25 U.S. Patent 7,321,193. 11:07

1 (Exhibit Number 2 was marked.) 11:07
2 THE WITNESS: Do we bring it up? Is
3 it possible?
4 MR. YANG: I can help.
5 THE WITNESS: So we have a new 11:08
6 exhibit?
7 MS. ZHONG: I have not introduced
8 Exhibit 1 yet.
9 MR. YANG: The 193 exhibit, is that
10 Exhibit 2? 11:08
11 MS. ZHONG: Yeah, Exhibit 2.
12 MR. YANG: Click on it.
13 THE WITNESS: Yes.
14 BY MS. ZHONG:
15 Q. And U.S. Patent Number 7,321,193 is a 11:08
16 patent by you and Dr. Benjamin Claus Krummacher;
17 is that correct?
18 A. Yeah. Benjamin Claus Krummacher,
19 yes.
20 Q. And part of it is discussing a 11:08
21 luminescence conversion layer in OLED, correct?
22 A. Correct.
23 Q. And Dr. Krummacher was -- strike
24 that.
25 Dr. Krummacher is the first inventor 11:09

1 of that patent that we -- you just mentioned, 11:09
2 the Osram patent you just mentioned about down
3 conversion?

4 A. Yes. All these patents -- the family
5 of all these patents were filed after I left. I 11:09
6 remember this particular one and I know the
7 story behind this, but all the subsequent
8 patents are -- were filed after my departure.

9 Q. Okay. Can you please go to column 6,
10 lines 61 to 66? 11:09

11 MR. YANG: You can feel free to read
12 whatever language you need to to get the right
13 context.

14 THE WITNESS: Yes. Let's kind of
15 blow it up. 11:09

16 So I'm at page 6, column 6 -- can you
17 repeat, please.

18 BY MS. ZHONG:

19 Q. Line 61 through 66.

20 A. (Witness reviews document.) 11:10

21 Yes.

22 Q. And so one example of the
23 color-changing material is quantum dots as are
24 listed here, correct?

25 A. Yes. 11:10

1 Q. So Dr. Krummacher is aware that 11:10
2 quantum dot can be an example of a
3 color-changing material, correct?

4 A. Yes. Already the world knew that
5 quantum dots can absorb light and down convert 11:10
6 it. There were startups that were working in
7 these areas.

8 Q. So Dr. Krummacher is in possession of
9 the concept of using quantum dots for
10 down-converting light, for example, correct? 11:11

11 A. Yes. He lists all different media,
12 all media that can manifest the down conversion
13 phenomena. Everything is listed here to our
14 knowledge.

15 Q. Can you look at the next sentence 11:11
16 which is starting from column 6, line 66 to
17 column 7 -- column 7, line 3?

18 A. Yep.

19 Q. Do you see the term "matrix
20 material"? 11:11

21 A. Matrix material, yep.

22 Q. What is a matrix material?

23 MR. YANG: Objection.

24 THE WITNESS: Well, it depends on the
25 usability. It means different things in 11:12

1 different -- from relations in different 11:12
2 applications. Can you repeat the question,
3 perhaps, with more specific to this application?

4 BY MS. ZHONG:

5 Q. What does -- how are you -- strike 11:12
6 that.

7 What does matrix material mean to you
8 in this patent?

9 A. In this particular sentence, it's a
10 carrier for the color-changing material. The 11:12
11 analogy there will be an almond chocolate. The
12 chocolate is the matrix and the almond is the
13 dot or the color-changing material.

14 Q. And how is matrix materials typically
15 used in the OLED field? 11:13

16 MR. YANG: Objection.

17 THE WITNESS: It's a different
18 question, not directly related to these
19 sentences. It depends, again, on the usability
20 of the matrix materials. 11:13

21 "Matrix material" is very generic
22 term. It's used in down conversion for the
23 OLED field. It's used in electron injection.
24 It's used in light emission or even in some
25 cases to -- at the hole transport too. So we 11:13

1 need to examine it function by function, case 11:13
2 by case.

3 BY MS. ZHONG:

4 Q. What is matrix material as used in
5 light emission? 11:14

6 MR. YANG: Objection.

7 THE WITNESS: Are you referring to
8 the emission layer?

9 BY MS. ZHONG:

10 Q. So I'm referring to your testimony -- 11:14
11 you said "'matrix material' is a very generic
12 term. It's used in down conversion for the OLED
13 field. It's used in electron injection. It's
14 used in light emission or even in some cases at
15 the hole transport too." 11:14

16 So I'm asking you what you are
17 referring to -- what does matrix material mean
18 as it's used in light emission?

19 A. In the example of light emission
20 layers, the matrix material is the material that 11:15
21 receives the electrons and the holes, and
22 it's -- upon recombination, the energy from that
23 electron-hole recombination, the energy is
24 transferred to the emission molecule.

25 So the matrix material is the 11:15

1 material that provides the transport and the 11:15
2 emission comes from the guest. Often the term
3 "host guest" is used. The matrix plays the role
4 of the electronic transport and the emission in
5 this case will come from a guest, the material 11:15
6 that you put into the matrix.

7 Q. So for light emission layer, matrix
8 material is synonym -- synonymous to host
9 material; is that correct?

10 A. I have seen those two terms used 11:16
11 interchangeably in the industry, not only OLEDs
12 but also other fields.

13 Q. What about in hole transport or
14 electron injection?

15 A. So I'm not very familiar with what 11:16
16 the industry is using today in the hole
17 transport, but in the case of the electron
18 transporting, you may have two materials. You
19 may have a material that facilitates the
20 electron transport, and you may have a second 11:16
21 material that adapts the first material to
22 change the electronic properties of the electron
23 transport layer so they can conduct more
24 electrons but also can receive electrons from
25 the cathode easier. 11:17

6 In the case of the emission layer,
7 it's a photonic interaction. You don't have
8 electron change or anything like that. And
9 sorry, that's why I said it depends, right? In
10 solid-state lighting in LEDs, the little 11:17
11 transparent bulb that we see in front of the
12 LEDs, again, consists of matrix material.
13 Typically, this is silicones and other type of
14 materials, and they host -- sorry. The guests
15 are phosphorus materials. 11:18

16 Q. So the matrix materials are different
17 from dopants of guest materials; Is that
18 correct?

19 A. That's my understanding, in most
20 cases, yes. 11:18

21 Q. Would you have been capable of
22 assessing infringement if asked to?

23 A. I'm not an expert in assessing
24 infringement. If someone trains me to do the
25 exact function, I could do it. But right now, 11:18

1 A. Correct. 11:20

2 Q. So you did not consider any of the
3 patents as part of your report; is that correct?

4 A. Of course, no, I did not.

5 Q. So you did not think that the patents 11:20
6 are relevant to what you were opining in your
7 report; is that correct?

8 A. The report was written in an
9 independent fashion, and it only focuses on the
10 innovations that I perceived after reading I 11:20
11 don't know how many pages of Samsung display
12 confidential information that became available
13 to me.

14 What the report includes is my
15 personal assessment based on my expertise on the 11:21
16 aspects that impressed me the most that happened
17 to enable the success of Samsung in the
18 marketplace. And this is something that some of
19 my opinions are new, but some others I knew.
20 The industry knows this thing already, who 11:21
21 Samsung is and what they have done.

22 Q. So you reviewed certain Samsung
23 display documents as part of your report,
24 correct?

25 A. Yes. 11:21

1 Q. And how did you pick out those 11:21
2 particular documents?

3 A. No. I reviewed everything page by
4 page. I reviewed all pages from the report --
5 from the reports. 11:21

6 Q. Sorry. It's a slightly different
7 question. So you reviewed specific Samsung
8 documents, correct?

9 A. The ones that were made available to
10 me, yes. 11:22

11 Q. Okay. So did you pick out specific
12 documents or someone provided them to you?

13 A. The -- Samsung through my legal
14 counsel here provided to me. I reviewed
15 everything that was given to me. 11:22

16 Q. Did you review -- so those documents
17 were picked out by Samsung counsel and provided
18 to you and then you reviewed them; is that
19 correct?

20 A. They were given to me by Lance and 11:22
21 his team through Samsung, I take it.

22 Q. And was it at your request to say you
23 want to see certain types of documents, or were
24 they just provided to you?

25 A. No. They were -- the documents 11:22

1 were -- it was a collection of documents that 11:23
2 they were given to me, and I was asked to
3 provide an opinion about these documents.

4 Q. And none of those documents related
5 to materials used in the OLED manufacturing; is 11:23
6 that correct?

7 MR. YANG: Objection.

8 THE WITNESS: I would say yes. The
9 documents that I reviewed involved what has
10 enabled the manufacturability of displays at 11:23
11 Samsung's hands, but it's all about
12 manufacturing and what matters in manufacturing
13 and the products, per se.

14 BY MS. ZHONG:

15 Q. But you did not look at the 11:23
16 contribution of the material set and how that
17 contributed to the color gamut, lifetime, or
18 efficiency of device?

19 A. The materials, no. I don't know what
20 Samsung's doing with materials. 11:24

21 Q. And do you think that those
22 manufacturing documents or improvement negate
23 the need to have the right material set in the
24 first instance?

25 MR. YANG: Objection. 11:24

1 THE WITNESS: Can you repeat the 11:24
2 question? Sorry. I didn't fully understand it.
3 I didn't understand the word "negate" in
4 relation to your sentence. Can you repeat,
5 please? 11:24

6 BY MS. ZHONG:

7 Q. So to have a commercially viable OLED
8 device, one of the first things you have to have
9 is to have the right material set for the OLED
10 stack, correct? 11:25

11 A. Yes.

12 Q. Okay. And if the material set does
13 not work as intended, the manufacturing process
14 is unlikely to make a good OLED device in the
15 end, correct? 11:25

16 A. Yep.

17 Q. Okay.

18 A. I agree.

19 Q. That's what I mean, is all those
20 manufacturing improvement process, whatever, 11:25
21 they don't negate the need for you to have the
22 right set of materials?

23 A. Correct. There are multiple
24 parameters that work together delivering a
25 product. It's a very complex system as you 11:25

1 know. 11:25

2 Q. Yeah. So basically in order for

3 Samsung to offer a commercially viable product

4 with OLED displays, manufacturing is just part

5 of it. There were other parts of it that -- 11:26

6 related to documents that you have not reviewed,

7 correct?

8 A. Correct.

9 Q. For example, the manufacturing

10 documents you have reviewed does not negate the 11:26

11 need for a material set that balances the

12 electrons and the holes in the OLED stack,

13 correct?

14 A. Yep. They work together hand in

15 hand. You need to have both. 11:26

16 Q. And those are kind of independent

17 criteria of OLED development needs?

18 MR. YANG: Objection.

19 THE WITNESS: In an R&D environment,

20 you have to develop the processes in parallel 11:26

21 with the material's performance. That's why

22 these teams have both device development teams

23 and process development teams before the whole

24 concept goes into manufacturing.

25 / / /

1 BY MS. ZHONG: 11:27

2 Q. So improvement in the material
3 properties is independent of improvement, for
4 example, in improving the capacity of the
5 product line, correct? 11:27

6 MR. YANG: Objection.

7 THE WITNESS: It depends, actually.
8 There are many cases where you may have a
9 material that apparently looks great at an R&D
10 level, but when you push it into mass 11:27
11 production, it doesn't deliver mass production.

12 A good example is the inkjet printing
13 of red, green, and blue of light-emitting
14 polymers. The industry has yet to deliver what
15 they show being potential for full color. They 11:28
16 cannot manufacture it at a high volume. So
17 they're interlinked in some cases. It's
18 interlinked, right?

19 The materials -- hole transporting,
20 electron transporting, electron emission, they 11:28
21 may appear ready, but when you push them under
22 certain environments, they don't work. And
23 that's why inkjet printing of RGB materials is
24 not happening yet. It's exactly -- they are
25 not -- they're not isolated, right? 11:28

1	On the other hand, if you do, let's	11:28
2	say, metalization, copper, if you demonstrate	
3	in a 200-millimeter line, it can easily	
4	transfer to a gen six line. So it depends on	
5	the material. It depends on the application.	11:29
6	It depends on many cases.	

7 BY MS. ZHONG:

A horizontal bar chart titled 'Percentage of respondents who believe that the current administration is responsible for the current state of the world, by age group'. The y-axis lists age groups: 18-29, 30-49, 50-69, 70+, and All. The x-axis represents the percentage from 0 to 100. The bars show the following approximate values: 18-29 (85%), 30-49 (80%), 50-69 (90%), 70+ (85%), and All (85%).

Age Group	Percentage
18-29	85%
30-49	80%
50-69	90%
70+	85%
All	85%

17

Response	Percentage
Yes	17
No	83

25	Q. Okay. So you're not offering any	11:30
----	-------------------------------------	-------

1 opinion as to whether the increase in capacity 11:30
 2 actually is improving the final device's
 3 property, for example?

4 A. Performance? I don't -- if I
 5 remember correctly, I don't think this was -- 11:30
 6 became available to me. I don't think I know
 7 the answer to this.

8 Q. I'm asking you: Did you offer an
 9 opinion in your report regarding how the
 10 increased throughput is affecting the device's 11:30
 11 performance, for example?

12 A. I don't remember this. But that
 13 doesn't sound familiar. I don't think I did
 14 this.

15 MR. YANG: You can check your report, 11:31
 16 yeah.

17 BY MS. ZHONG:

18 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED] 11:32

1

[REDACTED]

18

[REDACTED], I 11:34

1

[REDACTED]

[REDACTED]

11:35

11:36

■ : 38

11:39

1

[REDACTED]

[REDACTED]

11:41

11:42

1

[REDACTED]

11:42

2

Q. Did you ask for that information?

3

A. I have not.

4

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED],

11:43

11:45

[REDACTED]

[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

11:47

1

[REDACTED]

[REDACTED]

11:48

11:50

[illegible]

11:51

Page 100

Page 101

1

[REDACTED]

[REDACTED]

11:55

1

[REDACTED]

[REDACTED]

11:57

[REDACTED]

[REDACTED] [REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

1

[REDACTED]

[REDACTED]

12:01

of

Page 106

1

[REDACTED]

[REDACTED]

12:03

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

110

1

3

MS. ZHONG: So we're slightly after
noon right now.

5

6

Do you want to take a lunch break or 12:08
you want to continue?

7

8

9

MR. YANG: So let's get off the
record and then we can discuss how the break
will be.

10

11

THE VIDEOGRAPHER: Off the record at 12:08
12:08 p.m.

12

(Recess.)

13

14

THE VIDEOGRAPHER: We are back on the
record an 1:13 p.m.

15

BY MS. ZHONG: 01:13

16

17

Q. Welcome back, Doctor. I want to
verify a couple of things.

18

19

20

So Osram already had a OLED program
when you joined the company in January 2000; is
that correct? 01:13

21

A. I believe so.

22

23

24

Q. And is it your opinion that Osram was
a pioneer in solution-based OLED devices; is
that correct?

25

A. That's what I said, yes. 01:13

1 Q. And Osram commercialized 01:13
2 solution-based OLED display panels by 2003; is
3 that correct?

4 A. Yes. The first introduction was done
5 in 2003, May 2003. 01:14

6 Q. And the work Osram did between 2000
7 and 2003 on OLEDs allowed it to receive a --

8 THE COURT REPORTER: Can we go off
9 the record for a minute.

10 MS. ZHONG: Sure. 01:14

11 (Brief recess.)

12 THE VIDEOGRAPHER: On the record.

13 1:18 p.m.

14 BY MS. ZHONG:

15 Q. So, Doctor, the work Osram did 01:18
16 between 2000 and 2003 in OLED allowed it to
17 receive a multiyear multimillion dollar research
18 grant from the Department of Energy; is that
19 correct?

20 A. Yes. It's related to this -- not the 01:18
21 only reason, but yes. Qualified for the DOE
22 program.

23 Q. Okay. And the DOE program ended in
24 2005 when Osram decided to move its OLED program
25 to its headquarters in Germany; is that correct? 01:18

1 A. I don't know all the reasons but the 01:19
2 DOE program indeed ended December 2005.

3 Q. And Osram invested about \$3 million
4 between 2003 and 2005 on the Department of
5 Energy, DOE -- the Department of Energy OLED 01:19
6 program; is that correct?

7 A. About this much.

8 Q. And as part of the Department of
9 Energy OLED program, Osram not only investigated
10 the development of a white OLED lighting source 01:19
11 but also explored the possibility of developing
12 full-color display panels based on
13 inkjet-printed red, green, and blue pixels; is
14 that correct?

15 A. Yes. 01:19

16 MR. YANG: Objection.

17 Go ahead.

18 THE WITNESS: Let me make a
19 clarification about this just to better explain
20 what I meant by that. There are two ways to 01:20
21 make white light. One is to get white light
22 coming from a single layer that includes all the
23 emitters. The other approach was to use three
24 lateral layers, RGB layers, that gives you white
25 of a different hue. 01:20

1 So it's -- the word full color, 01:20
2 usually it's assigned to displays. What I
3 meant to say, and to be correct, the RGB
4 striped light source was used for rendering
5 multiple whites hoping to achieve higher-power 01:20
6 efficiency.

7 BY MS. ZHONG:

8 Q. And the RGB stripes can also allow
9 Osram to develop a display with full-color
10 gamut; is that correct? 01:21

11 MR. YANG: Objection.

12 Go ahead.

13 THE WITNESS: Yeah. Not really. We
14 did the very first-level investigation in inkjet
15 printing RGB. We were able to put a quality of 01:21
16 RGB stripes, but the colors were not that great
17 and did not really qualify the process for
18 full-color displays, but it was a demonstrator
19 to show that lighting can be done by putting
20 down RGB stripes. It was an R&D project, not a 01:21
21 product, a demo.

22 BY MS. ZHONG:

23 Q. Okay. So as part of the DOE OLED
24 program, Osram made a demonstrator with RGB
25 stripes; is that correct? 01:22

1 A. Yes. Correct. 01:22

2 Q. And the RGB stripes could lead to a
3 color display panel; is that correct?

4 MR. YANG: Objection.

5 THE WITNESS: Well, it depends. It's 01:22
6 related, remotely related to full-color display.

7 You cannot use the same demo for display

8 purposes. We use stripes. So you cannot -- we

9 didn't use pixels. You need pixels in a display

10 not stripes. 01:22

11 BY MS. ZHONG:

12 Q. Can that concept be applied to
13 display panels?

14 MR. YANG: Objection.

15 THE WITNESS: So the DOE demo was 01:23
16 100 percent focused on lighting. We did not

17 using driving electronics. We did not use

18 pixels. So that concept, per se, cannot be used

19 for displays.

20 What we learned is how hard it is to 01:24

21 use inkjet printing for RGB patterning. That's

22 all we managed to push this technology. And we

23 learned this thing on the lighting panel rather

24 than display. The display is even harder. But

25 even for lighting it was hard. But it was a 01:24

1 great demo, and so the potential of the 01:24
2 technology long term.

3 BY MS. ZHONG:

4 Q. Can you please refresh your exhibit
5 share and see whether you see an Exhibit 5. 01:24

6 A. Yes. I see it. I'm opening it.
7 Yep.

8 (Exhibit Number 5 was marked.)

9 BY MS. ZHONG:

10 Q. So Exhibit 5 is a document with the 01:24
11 title "Final Technical Progress Report, Polymer
12 OLED White Light Development Program, bracket
13 number DE-FC26-04NT419," end bracket.

14 A. Sorry. I didn't capture -- do you
15 mind, because I was looking at the DOE report, 01:25
16 would you mind repeating? I'm sorry.

17 Q. So Exhibit Number 5 is a report with
18 a title "Final Technical Progress Report,
19 Polymer OLED White Light Development Program."

20 A. Yes. 01:25

21 Q. Bracket number -- the number sign
22 DE-FC26-04NT41947, end bracket. Is that
23 correct?

24 A. Yes. Yes.

25 Q. Is this the DOE final report you 01:25

1 mentioned in your earlier answers? 01:25

2 A. Yes.

3 Q. And were you one of the authors of

4 the report?

5 A. Yeah. I coordinated this report. 01:26

6 All the authors are written there, but yes, I

7 was the program director.

8 Q. And what is your response -- what was

9 your responsibility as the program director of a

10 DOE grant? 01:26

11 A. I was responsible for bringing in the

12 money from the DOE and maintaining the relation

13 with the Department of Energy to qualify Osram

14 for this funding.

15 Q. What about technically, what was 01:26

16 your -- did you play any role?

17 A. Of course. I coordinated the program

18 at a high level. When we -- when we submitted

19 the proposal, the overall strategy of the demos

20 and what we will pursue, I was behind that. The 01:26

21 nitty-gritty details of how we will make the

22 devices, the device development work was done by

23 some of the members that you see there. And I

24 can tell you what everybody did.

25 Q. Sure. Sure. Go ahead. 01:27

1 A. So the program was organized in 01:27
2 tasks. And each task had different
3 deliverables. I was responsible functionally
4 within the OLED Osram group for product
5 development. So my team was responsible for the 01:27
6 demonstrators. You can see task four. I was
7 technically responsible for this.

8 We had a device development team
9 that's task one. And what you see as task one
10 is how you make the devices that emit white 01:27
11 light.

12 Task three, by Raul Gupta was the
13 inkjet printing task.

14 And task two was the fabrication of
15 the glass substrate. The -- right. 01:28

16 And you can see that Franky So, the
17 name that you referred to in the beginning, he
18 was, of course, part of the program.

19 Q. And what was some of the highlights
20 of this DOE program? 01:28

21 A. From what I remember, the tasks --
22 the deliverables of the tasks were the
23 highlights. Task one we deliver a white
24 emitting soluble technology where the emitters
25 and the transports were all blended together in 01:29

1 a pretty much single layer. And the team did a 01:29
2 lot of good work to balance the electron and the
3 whole transport. That's one.

4 Task two was the engineering of
5 either -- the engineering of the substrates. We 01:29
6 had to pattern the substrates with
7 photolithography as well as metalization and
8 prepare the substrates for publication.

9 Task four was the actual products.
10 We put together the drivers, the packaging, the 01:29
11 frames, power supplies, and the -- and
12 deliverables to the DOE.

13 Those -- and task three is the
14 attempt to make white light out of red, green
15 and blue stripes and deliver that in a module in 01:30
16 a natural demonstrator.

17 Q. Can you please go to page 71 of the
18 report.

19 A. Yeah.

20 Q. So Section 4.3.5.1 -- 01:30

21 A. What page, sorry?

22 Q. 71.

23 A. Can I type here? Can I type right
24 here? 71. Sorry.

25 Yeah. 71. Yes. 01:30

1 Q. So Section 4.3.5.1 -- 01:31

2 A. Yes.

3 Q. -- concerns the color gamut of RGB

4 tiles and efficiency of white, correct?

5 A. Yes. 01:31

6 Q. And so the range of color tunability

7 in Figure 5.31 concerned the color tunability of

8 the light demonstrator; is that correct?

9 A. Yes.

10 Q. And it's not optimized yet? 01:31

11 A. No. No. It was -- as you can see,

12 the triangle was very narrow. We didn't have

13 the right blue and it was -- you know, it was a

14 defective product. We were very proud of the

15 product, but it was not really top performing. 01:31

16 It's a great R&D result.

17 Q. And on the next page, Figure 5.32, is

18 that intended to show what you believe you could

19 achieve with some of the approaches listed

20 above? 01:32

21 A. Yeah. Do you mind, give me a little

22 bit of time to read this.

23 Q. Sure.

24 A. I don't remember very well this

25 particular one. 01:32

1 Yeah. It describes in a theoretical 01:32
2 way the three different approaches that we can
3 render white.

4 Q. Do you know, after the program was
5 moved to Germany, did the German group continue 01:32
6 with the development of this concept?

7 A. I don't know. I lost contact with --
8 after I left also.

9 Q. Okay. So you don't know what
10 happened after 2005 at Osram's -- at Osram's 01:33
11 OLED program?

12 A. I don't. All I know is that they
13 were focusing on something different. I left a
14 little bit earlier. My group and the rest of
15 the team stayed until summer or something of 01:33
16 2006, after which a lot of the stuff were
17 transferred elsewhere. Germany, I guess.

18 Q. Now, let's talk about the -- your
19 report that you submitted in this -- in this
20 action. 01:34

21 For this report, you were not asked
22 by counsel to analyze invalidity of the patent,
23 correct?

24 A. That's correct. No, I was not asked.

25 Q. And you were not asked to analyze the 01:34

1 infringement of the -- by Samsung's products, 01:34
2 correct?

3 A. Yes. That's correct. I was not.

4 Q. Were you asked to quantify the
5 improvement that each of the techniques you 01:34
6 discussed in your report?

7 MR. YANG: Objection.

8 THE WITNESS: Can you repeat the
9 question? Give me a little bit more
10 information. 01:34

11 BY MS. ZHONG:

12 Q. Sure.

13 So you were provided by counsel a
14 number of documents, correct?

15 A. Yes. 01:35

16 Q. And you reviewed those documents?

17 A. Yes.

18 Q. And you specifically discussed a
19 subset of those documents in your report,
20 correct? 01:35

21 A. Yes.

22 Q. Okay. And did you quantify the
23 improvement each of the techniques brought by?

24 MR. YANG: Objection.

25 THE WITNESS: After reviewing the 01:35

1 report, I highlighted the areas that I 01:35
2 considered to be the most important for enabling
3 the manufacturability of OLED displays.

4 BY MS. ZHONG:

5 Q. So, for example, did you provide a 01:35
6 number to say this technique improved the
7 efficiency of the devices by X percent? That
8 technology increased the lifetime of the device
9 by X percent. Did you perform that analysis?

10 A. Not exactly. 01:36

11 Q. And you did not provide -- strike
12 that.

13 And the full-color gamut, you also
14 did not provide -- you also did not quantify
15 the perceived improvement of the technique; is 01:36
16 that correct?

17 A. I did not. And I don't remember
18 seeing these things in the report. I don't
19 remember these things. So I did not. The only
20 quantification that I repeated was in relation 01:36
21 to, let's say, [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

24 Q. So the only thing that I remember you
25 could quantify is probably the [REDACTED] 01:36

1 [REDACTED] 01:36

2 A. Yes. And [REDACTED] yes.

3 Q. But there was nothing -- there was no
4 quantified analytical results for lifetime
5 improvement, device efficiency improvement or 01:37
6 color gamut improvement?

7 MR. YANG: Objection.

8 THE WITNESS: Yeah. Let me review
9 and I will bring you an example. There is some
10 quantification, for example, [REDACTED], I 01:37
11 will draw you to -- [REDACTED]

12 [REDACTED] on page 30 of my report -- talks about
13 [REDACTED]. This is -- to me it
14 strike me as a very important processing step.
15 Comes across as a trade secret. [REDACTED] [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

19 [REDACTED]

[REDACTED] [REDACTED] [REDACTED] 01:38

21 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] 01:38

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

01:40

10

5



11

10



100

100



19



21

22

23

24

25

Q. Okay. Did you investigate the [REDACTED]

██████████ over lifetime if you use a ██████████ 01:41

nonselective deposition technique for forming

the thin film encapsulation versus a more

selective deposition technique?

MR. YANG: Hold on a second.

Objection. 01:42

1 THE WITNESS: Can you please explain 01:42
2 what you mean by "selective."

3 BY MS. ZHONG:

4 Q. For example, when the material is
5 deposited in the targeted material area rather 01:42
6 than it's a blanket application.

7 A. I see. [REDACTED]

8 [REDACTED]

9 [REDACTED]

10 [REDACTED]

11 [REDACTED]

12 A. Okay. So selective in relation to
13 thin film encapsulation?

14 Q. Correct.

15 A. With respect to the organic and 01:42
16 inorganic, with respect to what layers, please?

17 Q. Either layer. Either or both.

18 A. So the report, to my recollection,
19 doesn't talk about this specific selective or
20 nonselective deposition. But the report, what I 01:43
21 reviewed, talks about thin film encapsulation.

22 [REDACTED]

23 [REDACTED]

24 [REDACTED]

25 [REDACTED] -- 01:43

1

[REDACTED]

10

[REDACTED]

01:44

21

Q. [REDACTED]

[REDACTED]

23

A. When I was with Kateeva, we publicly

24

shared with the world that more than 80 percent

25

of the OLED displays are made with Kateeva

01:45

10



5

2



8

9

5

7

5

7

5

1

1

25

Q. Now, so what's the advantage of using inkjet printing versus flash evaporation for putting down the organic layer in the thin film encapsulation -- for the instant film encapsulation?

THE WITNESS: Inkjet printing would offer better control of the material usability. You only -- it's an additive process and you can 01:47

1 share and see whether there is an Exhibit 01:50
2 number 6?

3 A. Yes.

4 (Exhibit Number 6 was marked.)

5 THE WITNESS: Yep. 01:51

6 BY MS. ZHONG:

7 Q. And Exhibit 6 is a presentation by
8 Kateeva with a title "Inkjet Technology for OLED
9 SSL Mass Production" by Conor Madigan.

10 Do you see that? 01:51

11 A. Yep.

12 Q. Can you please go to -- by the way,
13 do you know who Dr. Madigan is?

14 A. Yep.

15 Q. Who is he? 01:51

16 A. He is one of the three founders of
17 Kateeva.

18 Q. Is he knowledgeable in the OLED
19 space?

20 A. Well, he is the founder, a cofounder 01:51
21 of Kateeva, and he was very successful in
22 raising money. So he knows the OLED technology.

23 Q. What's his technical background?

24 A. I believe he did his undergraduate
25 degree in Princeton and a Ph.D. in MIT. 01:52

1 Q. Did he work for Steven Forrest at 01:52
2 Princeton?

3 A. No. He did his undergraduate. He
4 has one of the very first papers in the 90s on
5 inkjet printing, around that time, with Jim 01:52
6 Stern, Professor Jim Stern.

7 Q. Okay. What does "SSL" stand for?

8 A. I don't know. Solid-state lighting
9 in my lighting background, but it's not
10 solid-state lighting. I don't know what it 01:52
11 means. Sorry.

12 Q. That's fine.

13 Can you please go to page 17.

14 A. Yes.

15 Q. So this page is comparing Kateeva's 01:53
16 inkjet printing process versus the traditional
17 flash evaporation process, correct?

18 A. Let me review that, please.

19 Q. Sure.

20 MR. YANG: While he's doing that, 01:53
21 Monice, I still haven't received the link yet
22 and the one in the chat is not working for me.

23 MS. ZHONG: I didn't send. I thought
24 she was going to send, so I didn't bother. I
25 can do that. 01:53

1 THE COURT REPORTER: Do you want to 01:53
2 go off for a second?

3 MR. YANG: If you can that would be
4 great.

5 MS. ZHONG: Okay. I can forward you 01:53
6 the remote counsel email. That's the one that I
7 used.

8 MR. YANG: Okay. Anything you can
9 get to me is great.

10 MS. ZHONG: I just forwarded the 01:54
11 link.

12 Let me know -- should we just go off
13 the record and see whether you have it?

14 MR. YANG: Sure. I'm okay with Q and
15 A until I get it. It's not a huge rush for me, 01:54
16 so...

17 BY MS. ZHONG:

18 Q. Okay. So we can continue.

19 Have you had a chance to review the
20 page, Doctor? 01:54

21 A. Yes.

22 So what we see on this page is the
23 comparison of -- in general, not necessarily to
24 TFE. It's -- well, it's labeled as TFE but then
25 Conor talks about RGB share mask, fine metal 01:55

1 mask for RGB patterning. 01:55

2 So in a sense he's mixing two
3 different layers of the OLED structure, which
4 is -- personally I don't believe with this
5 comparison. It's a bit of a marketing proposal. 01:55
6 But the value proposition for TFE is correct.
7 Right. I mean, in general inkjet printing is
8 known to deposit materials in specific areas. A
9 great example is inkjet printing, right? I
10 mean, this is accurate. 01:56

11 Q. So do you agree with his general
12 assessment that inkjet printing is faster in
13 forming a thicker film than flash evaporation?

14 A. It depends, right? It depends on the
15 application of -- for thin film encapsulation, 01:56
16 inkjet printing or screen printing are the best
17 ways to do it. But for RGB coating, it's a
18 completely different argument.

19 Q. Let's just focus on the
20 encapsulation, the organic layer. 01:56

21 A. Yeah. So we'll take the left-hand
22 side of the figures out because they're talking
23 about RGB deposition, which is yet to be proven
24 in mass production, where the right-hand side
25 it's more mature. It's in production today. 01:56

1 Q. So let's focus on the TFE organic 01:56
2 layer. Is it true that inkjet printing provides
3 a faster way of applying the organic layer than
4 flash evaporation?

5 A. I don't know this. Seriously, I 01:57
6 don't. It's a cleaner way to do it. But I
7 don't know -- a flash can be very fast too, but
8 it goes all over, right. So I don't know which
9 one's faster. Actually, flash may be even
10 faster. 01:57

11 Q. And do you know which one forms a
12 better planarization layer?

13 MR. YANG: Objection.

14 THE WITNESS: I know at Kateeva we're
15 using inkjet printing, but in truth I don't 01:57
16 know, right? Inkjet printing cannot do a large
17 area uniformly. You have to do it
18 step-by-step, right? So it depends on the
19 application. It depends on how you use inkjet
20 printing, right, for what application. You ask 01:58
21 me a general question, right? So typically the
22 TFE is used for printing pockets for guide
23 layers.

24 BY MS. ZHONG:

25 Q. Do you know about the particle 01:58

1 defects of using flash evaporation versus inkjet 01:58
2 printing?

3 A. I don't have personal experience. I
4 have experience with inkjet printing. So I
5 don't know the difference between the two. I 01:58
6 know that inkjet printing works well and it
7 doesn't generate unwanted particles.

8 MR. YANG: Objection.

9 BY MS. ZHONG:

10 Q. And do you know the materialization 01:58
11 rate for flash evaporation versus inkjet
12 printing?

13 A. I don't --

14 MR. YANG: Objection.

15 THE WITNESS: I don't know very well 01:58
16 what percentage of the film is utilized or not.

17 BY MS. ZHONG:

18 Q. And what about scalability?

19 A. So it depends, right? If your
20 substrate is very close to the source, then you 01:59
21 have very good materials utilization. But if
22 the substrate is very far, then you lose a lot
23 of the material, right. So I don't know how
24 flash evaporation will determine uniformity or
25 not. 01:59

1 Q. What about the ease or difficulty in 01:59
2 maintaining the equipment?

3 A. Clearly something that it's deposited
4 on demand. Perhaps it will give you better
5 control of the material, both in weight and in 01:59
6 space. But I don't know about the maintenance,
7 because the issue with inkjet printing is also
8 the head technology would need maintenance and
9 changing. So, I mean, how do you compare this?

10 Q. Did you speak to any Samsung 02:00
11 engineers when you prepared your report?

12 A. I did not.

13 Q. Okay. Did you ask to speak with any
14 of them?

15 A. No. I assume that my job was to read 02:00
16 all this and give my expert report.

17 Q. Did you speak with any of the other
18 Samsung experts in this case?

19 A. Well, over the years we know people,
20 but not for this case, of course not. This 02:00
21 is -- I haven't even told my kids about this
22 case.

23 Q. So you did not speak to Drs. Katona,
24 Kymissis, Miller or Aziz?

25 A. Who's the last one? 02:00

1 Q. Hany Aziz. 02:00
2 A. I know Hany, but no. I haven't
3 spoken to him for a long time. No.
4 Q. And you have not spoken with Dr. Seth
5 Miller or Dr. Katona or Dr. Kymissis, correct? 02:01
6 A. No. I know Dr. Kymissis, but I --
7 no. Of course not.
8 Q. What about the damages expert for
9 Samsung? So Dr. Perryman and I don't know
10 whether it's Mr. or Dr. Stack? Did you speak 02:01
11 with any of them?
12 A. I don't know them. I have not spoken
13 to them.
14 Q. So you submitted this report in this
15 action. What are you rebutting against? 02:01
16 MR. YANG: Objection.
17 THE WITNESS: I don't understand the
18 question.
19 BY MS. ZHONG:
20 Q. So your report is submitted as a 02:01
21 rebuttal report. Do you understand that?
22 A. No. The way I see it, it's an expert
23 report. I absorb the materials, I digested them
24 and highlighted what I thought were the
25 take-home messages for me as an expert in the 02:02

1 OLED field revolving around the capability of 02:02
2 SDC to overcome the barriers and push the
3 technology into manufacturing. That was the
4 thesis in my head.

5 Q. But are you responding to the expert 02:02
6 reports put forth by Pictiva?

7 A. No, no. As a matter of fact, I find
8 my expert report almost totally irrelevant to
9 Kateeva. It's -- the only common path here is
10 the fact that they're both OLED related, because 02:02
11 as we discussed, Kateeva was doing --

12 Q. Sorry. Not Kateeva, Pictiva.

13 A. Sorry, Pictiva. I'm sorry, I should
14 say that was a mistake. Strike that.

15 Osram and then Pictiva, they were 02:03
16 doing spin coating in passive matrix displays.
17 There's nothing related to this in this report.
18 The Osram puts forward passive matrix displays.
19 Very low resolution. A good portion of the
20 display. It talks about [REDACTED], 02:03
21 high-resolution displays what are used today,
22 right? So they're almost irrelevant, I would
23 say, of each other.

24 Q. You know what -- strike that.

25 Do you know when Osram first started 02:04

1 to look into using inkjet to print the OLED 02:04
2 matrices?

3 MR. YANG: Objection.

4 THE WITNESS: Can you -- you said
5 matrices and it threw me off. You're talking 02:04
6 RGB materials?

7 BY MS. ZHONG:

8 Q. Yes.

9 A. I don't remember the exact time. For
10 sure as described in the Department of Energy 02:04
11 report, because we had a printer, an inkjet
12 printer that we were using to print RGB
13 materials, and in general before purchasing the
14 printer, we looked at who was providing the
15 printers. I don't know if it was 2001, 2002. 02:05

16 We ended up acquiring the printer so
17 I don't remember exactly when. I mean, not
18 earlier on, because earlier on we wanted to
19 build the line that would make this monochrome
20 display, so the priority was monochrome. 02:05

21 Q. But even back then, even when you
22 were building the monochromic display, you also
23 looked into the possibilities of inkjet
24 printing; is that correct?

25 A. Yeah. So let me clarify a little 02:05

1 bit. We're talking about inkjet printing red, 02:05
2 green, and blue materials. I'm looking at
3 converse, comparison versus TFE. The technology
4 is very different. So to print red, green, and
5 blue, all that materials, the nozzle technology 02:06
6 is very different.

7 Printing the TFE, it requires a
8 completely different inkjet printing technology.
9 As a matter of fact, it's made by a different
10 vendor. So the throughput of materials in one 02:06
11 is totally incompatible with the other and vice
12 versa.

13 The placement accuracy is very
14 different. So let's make sure that we make the
15 distinction that developing, let's say, TFE, 02:06
16 doesn't qualify you for full color and vice
17 versa, developing full color doesn't qualify you
18 for TFE. These are different engines, right, so
19 you cannot infer one from the other.

20 Q. Are you saying that the inkjet 02:06
21 printing technology for TFE encapsulation is
22 very different than the inkjet printing
23 technology for the OLED pixel areas?

24 A. Yes. Yes. That's a good question.
25 Very different indeed. And the proof to this is 02:07

1 that the very first displays that were made with 02:07
2 printing TFE, they're out in the market, we're
3 still waiting for RGB inkjet printable OLEDs.
4 And this we thought in the early 2000s that
5 inkjet printing will be superior to fine metal 02:07
6 mask. But it turned out to be the opposite.

7 After reading this report, it just
8 dawned on me how significant was Samsung's hard
9 work in taking a rather difficult technology to
10 the first glance, [REDACTED] [REDACTED]

11 [REDACTED]
12 [REDACTED] And inkjet printing OLEDs is not in
13 production today.

14 And the reason that it's not in
15 production today is because the inkjet printing 02:08
16 head technology for RGB is not accurate enough.
17 We thought 20 -- 35 years ago that this
18 technology would be 100 times more accurate than
19 fine metal mask.

20 And, by the way it was to the very 02:08
21 first approximation. But to the surprise of
22 everybody, Samsung has demonstrated that [REDACTED]
23 [REDACTED], it's actually the ultimate
24 technology.

25 Q. Why was the inkjet printing 02:08

1 technology for the pixel area not accurate 02:08
2 enough?

3 A. Yes. So can I make an analogy?

4 Q. Sure.

5 A. So imagine you're playing a 02:08
6 basketball game, and you are throwing the balls
7 to the basket. You want to hit all the balls
8 into the basket times 100.

9 Q. Okay.

10 A. Okay. So with other boards you are 02:09
11 printing -- each pixel consists of three
12 droplets and you have millions of pockets. You
13 have to hit them all precisely. So we're almost
14 there but not exactly.

15 So you have misplacement of the red, 02:09
16 green, and blue pixels. And you end up with
17 color defects. So to use the term that we have
18 been using, you are screwing up the gamut.
19 Eventually we will get there, but not today.

20 And this is very different than TFE. 02:09

21 Q. For TFEs you don't really have to
22 worry about how the pixels are placed, correct?

23 A. Yes, correct. To some degree. You
24 don't need the pockets. You are just deciding
25 the outer perimeter. And I don't know exactly 02:09

1 how Samsung or others are doing it, but you have 02:10
2 to use some confinement, but not of the degree
3 of the RGB printing.

4 Q. So are there specific challenges for
5 using -- for applying the TFE organic layer? 02:10

6 A. So one fundamental patent by Vitex
7 claims the organic layer to be shorter than the
8 inorganic layer, and the only way to achieve
9 this is by using accurate printing. That's the
10 clear advantage of inkjet printing. Because you 02:10
11 have some accuracy of, of course. You have
12 misfirings of droplets, but you can accurately
13 define the perimetry of the organic layer. And
14 you can control the thickness also. That's
15 another advantage. 02:11

16 Q. What do you mean by the organic layer
17 is shorter than the inorganic layer?

18 A. So a very fundamental patent by Vitex
19 is to make the organic layer shorter than the
20 inorganic layer. So the TFE consists of organic 02:11
21 and inorganic layers.

22 Q. So you basically want the inorganic
23 layer to envelope all sides of the organic
24 layer --

25 A. Yes. 02:11

1

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

02:15

23

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[illegible]

02:16

02:17

02:19

1

[REDACTED]

[REDACTED]

: 21

1

[REDACTED]

11

[REDACTED]

20

Q. And do you know the relative amount 02:22

21

of particles that's formed using flash

22

evaporation versus inkjet printing for TFE

23

formation?

24

A. I don't know.

25

MR. YANG: Objection. 02:22

1 BY MS. ZHONG: 02:22

2 Q. Do you know the throughput
3 improvement of using inkjet printing to deposit
4 the organic layer versus use a more blanket
5 application method to put down the organic 02:22
6 layer?

7 MR. YANG: Objection.

8 THE WITNESS: Yeah. I don't know. I
9 know that the inkjet printing is used in
10 production today. 02:23

11 BY MS. ZHONG:

12 Q. And do you know -- do you have any
13 sense as to the improvement in the throughput of
14 using an inkjet-printed process versus a
15 nonselective deposition process? 02:23

16 MR. YANG: Objection.

17 THE WITNESS: Yeah. I don't.

18 BY MS. ZHONG:

19 Q. And do you know the yield difference
20 when you use an inkjet printing process versus a 02:23
21 more blanket application process?

22 MR. YANG: Objection.

23 THE WITNESS: I don't. It's complex,
24 right? Because it's a printing also -- you need
25 to worry about your head technology. And if 02:23

1 nozzles clog, then you need to compensate for 02:23
2 the clogging nozzles. So it's a system so I
3 don't know. It's -- I know the technology has
4 been developed and work in manufacturing, but I
5 cannot comment on comparisons. I mean, I truly 02:24
6 don't know.

7 BY MS. ZHONG:

8 Q. Do you know why people migrate to
9 using inkjet printing for the organic layer for
10 the TFE? 02:24

11 MR. YANG: Objection.

12 THE WITNESS: I cannot give you a
13 complete answer because I don't know all the
14 details. I know one important -- one of the
15 important areas is the thickness control and the 02:24
16 edge control as we described earlier.

17 BY MS. ZHONG:

18 Q. What about particle defect control?

19 A. Well, I know Kateeva was doing all
20 this stuff in an inert environment with laminar 02:24
21 flow. So you're printing in ink with inkjet
22 printing so it's very difficult to assess the
23 particle because you are in a controlled
24 environment.

25 Q. Do you know the loss in lifetime if 02:25

1 after the organic layer you don't put down 02:25
2 another barrier layer on top of the organic
3 layer for the TFE?

4 MR. YANG: Objection.

5 THE WITNESS: I don't know. What I 02:25
6 know is one of the approaches you put another
7 inorganic layer on multiple organic layers and
8 multiple inorganic layers. I haven't seen data,
9 so I cannot comment.

10 BY MS. ZHONG: 02:25

11 Q. Do you know the loss of lifetime or
12 reliability if you apply the barrier layer or
13 the inorganic layer only to a portion of the
14 organic layer?

15 MR. YANG: Objection. 02:26

16 THE WITNESS: I cannot refer to
17 this -- I don't have access to this data to show
18 you, okay, here is the data, right? I did --
19 did I? I may have seen something in the Samsung
20 reports. I don't remember where, but I can -- 02:26
21 what I recall vaguely, I haven't put it in the
22 report, is that they have TFE versus non-TFE and
23 the TFE was more stable than the non-TFE.

24 Because I have all this knowledge
25 that comes from the past. I don't know if I 02:26

1 have seen it from Vitex or if I have seen it 02:26
2 from Samsung, but a TFE device is protected
3 where the non-TFE it's not.

4 BY MS. ZHONG:

5 Q. Do you know what's the improvement in 02:26
6 the lifetime?

7 MR. YANG: Objection.

8 THE WITNESS: No, it depends. It
9 depends on the conditions. It depends on how
10 you expose the device. For instance, in one 02:26
11 case, narrow case of maybe 85 -- 85 degrees C,
12 85 degrees humidity, you easily see no dark
13 spots on the TFE device after 240 or -50 hours,
14 which is a telling thing that the TFE works.

15 BY MS. ZHONG: 02:27

16 Q. Is it typical for a device
17 manufacturer to test the devices under 85/85
18 conditions versus room temperature?

19 MR. YANG: Objection.

20 THE WITNESS: Let me think a little 02:27
21 bit about it. Just a general question. I
22 believe it depends on the application. So it's
23 not typical. I have seen 85/85. I have seen
24 60/90, I have seen smaller numbers, higher
25 humidity. For instance, automotive guys are 02:27

1 asking for 85/85. 02:27

2 BY MS. ZHONG:

3 Q. But it is not atypical for a device
4 manufacturer to test the devices at temperatures
5 higher than room temperature, correct? 02:28

6 MR. YANG: Objection.

7 THE WITNESS: Let me think about it.
8 How do I answer this? So you're asking if it is
9 typical for a device fabricator to test the
10 devices under 85/85? 02:28

11 BY MS. ZHONG:

12 Q. Not necessarily 85/85 but at a
13 temperature that's above room temperature.

14 MR. YANG: Objection.

15 THE WITNESS: Well, the product that 02:28
16 you're building will define the testing criteria
17 for qualifying the product and passing certain
18 qualifications. Consumer products have a
19 different temperature. Automotive products have
20 a different testing temperature. Different 02:29
21 products are even worse. So it depends on the
22 product, right.

23 BY MS. ZHONG:

24 Q. But even for consumer products you
25 would test it above room temperature? 02:29

1 A. In some cases I have seen -- it 02:29
2 depends on the conditions of the testing. So if
3 you do a wet test like elevated temperature for
4 consumer products, it's customary in some cases
5 to ask for 60/90. 60 degrees C, 90 percent 02:29
6 humidity.

7 Q. So for a reliability test that's done
8 at a high temperature is usually called
9 accelerated lifetime testing, correct?

10 A. In some cases, yes. 02:29

11 Q. And you do that type of testing
12 because you can't wait for 10,000 hours for a
13 device to fail, for example?

14 MR. YANG: Objection.

15 THE WITNESS: In some cases. Not 02:29
16 always. Because there are a lot of different
17 tests. As a matter of fact, there are new kind
18 of degradation modes that appear under high
19 temperature, high humidity that you cannot link
20 to room temperature. They don't -- they cannot 02:30
21 be described with simple Arrhenius plots or
22 mathematical equations. This is not only true
23 for OLEDs, it's true for photovoltaics and other
24 devices too.

25 It's a -- the degradation mode is 02:30

1 very difficult and it depends on the mode of 02:30
2 degradation. You have multi modes and they are
3 all contributing together, and if you describe
4 this thing mathematically, you will end up with
5 a very ugly equation. So it's very difficult 02:30
6 to answer this question.

7 BY MS. ZHONG:

8 Q. So based on your knowledge for OLED
9 display panels for mobile devices, do they test
10 at higher temperatures? 02:30

11 MR. YANG: Objection.

12 THE WITNESS: To qualify the product
13 due to multiple tests, not only high
14 temperature. They do shock tests. They do drop
15 tests. They do dry heat. They do operational 02:31
16 lifetime, in room temperature and in high
17 temperature.

18 There are like 10 different tests
19 dictated by the IEEE protocols. They are
20 standard tests which I cannot recall right now 02:31
21 that the industry is offering for this.

22 BY MS. ZHONG:

23 Q. Why don't we take a look at pages 4
24 to 5 of your report, in particular paragraph 14.

25 A. Do you mind telling me the page 02:31

1 again. 02:31

2 Q. Paragraph 14 on pages 4 to 5.

3 Page 4 -- like page 4 and page 5.

4 A. Yes. Page 4 and page 5.

5 Yeah, I guess one of the IEEE 02:32
6 international standards is the IEC 62341.

7 Q. Okay. So the testing you have listed
8 here, the environmental stress test that acts
9 are accelerated aging through high
10 temperature/humidity cycling and accelerated 02:32
11 lifetime testing, those were typical tests
12 that's done by manufacturers, correct?

13 A. It depends on the application. It
14 could be a typical test for an application. I
15 just wrote it there because you really need to 02:32
16 test the devices under different conditions to
17 qualify it. If it's an automotive product, it
18 has a different code. It's not an IEC 62341,
19 it's something else, but you have to test the
20 devices under different conditions, yes. 02:32

21 Q. In the context of OLED devices, there
22 is current efficiency, power efficiency, and
23 external quantum efficiency, are those -- how
24 are those three efficiencies related to each
25 other? 02:33

1 A. So they're all remotely related. So 02:33
2 the quantum efficiency, it's directly related to
3 the normalized efficiency of converting -- this
4 is the electroluminescent quantum efficiency.

5 The percent of photons that you get out of the 02:33
6 percentage of charges that you inject into the
7 device.

8 The power efficiency, it's related
9 this, but it's more of a wall plug efficiency,
10 right. So you put energy in, in watts, 02:33
11 electrical energy, which is related to the
12 electrons and holes that you inject the current,
13 and what you measure is the optical output,
14 which is basically the number of photons at a
15 given energy. So they're all related. A 02:34
16 high-quantum efficiency will give you a
17 higher-power efficiency too.

18 Q. Does a higher-quantum efficiency
19 necessarily lead to a higher-power efficiency?

20 A. The power depends also on the 02:34
21 voltage. It depends, right. If all this
22 participates in the power in the -- in optical
23 power out. You can have 100 percent quantum
24 efficiency but operating 100 volts. That's a
25 lousy device. 02:35

1 Q. So a device with a higher-quantum 02:35
2 efficiency doesn't necessarily lead to a device
3 with a higher-power efficiency?

4 A. That's correct. That's one of -- you
5 can generalize by saying that. So to add one 02:35
6 more thing of what I said earlier, what I said
7 earlier, it's true for a single pixel.

8 Now, if your device has multiple
9 pixels you will also need to define if it's a
10 static image. If the image consists of how many 02:35
11 pixels at what brightness. Right. Because you
12 have -- it's complicated things. OLEDs are
13 devices that have variable quantum efficiency
14 and variable power efficiency.

15 And the OLED devices consist of many 02:35
16 pixels. A device, the OLED device where all
17 pixels are on consumes a lot more power versus
18 one pixel is on. Right?

19 Q. So there isn't a straightforward
20 direct relationship between external quantum 02:36
21 efficiency and power efficiency; is that
22 correct?

23 A. Yes. It's not a simple thing. You
24 can only do it for a single pixel.

25 MS. ZHONG: We've been going on for 02:36

1 almost an hour and a half now. Do you want to 02:36
2 take a break?

3 MR. YANG: Sure. Yes.

4 MS. ZHONG: Let's go off the record.

5 THE VIDEOGRAPHER: Off the record at 02:36
6 2:36 p.m.

7 (Recess.)

8 THE VIDEOGRAPHER: We are back on the
9 record at 2:54 p.m.

10 BY MS. ZHONG: 02:54

11 Q. Now, Doctor, when you prepared your
12 report, did you -- strike that.

13 As part of your -- the process for
14 preparing a report, did you review any of the
15 Pictiva's expert's reports? 02:54

16 A. No.

17 Q. Have you reviewed any of those
18 reports since then?

19 A. No.

20 Q. How long did it take you to review 02:54
21 the documents and prepare your report?

22 A. I can hear my voice -- can we --
23 something's not good.

24 MR. YANG: Sorry.

25 THE WITNESS: Because you have it on. 02:54

1 MR. YANG: Sorry about that. I 02:54
2 unmuted two things when I only meant to unmute
3 one.

4 THE WITNESS: I don't remember
5 exactly, but I spent about a week -- I don't 02:55
6 know how many hours I put for all of this. Let
7 me think a little about it. I cannot give you a
8 direct number because I don't have it with me.

9 I don't know. 15, 20 hours to read
10 all this stuff and then another -- this month 02:55
11 to put the report together to some degree. So
12 maybe a little bit more.

13 BY MS. ZHONG:

14 Q. Did you do a first draft of the
15 report? 02:55

16 A. Yes. I generated -- yes, quite a bit
17 of information. Yep.

18 Q. Did you focus on certain pages of the
19 documents that you reviewed?

20 A. Could you repeat, please? What do 02:56
21 you mean?

22 Q. Sure. Did you focus on certain pages
23 of the --

24 A. Yes. Certain pages of the SDC
25 disclosed information. 02:56

1 Q. Correct. Did you focus on certain 02:56
2 pages of the SDC documents?

3 A. Yeah. I mean, there may be other
4 documents in the Samsung that can be used, but
5 I -- the figures that we included or at least 02:56
6 the pages that I included, they represent
7 certain aspects of the technology. There's a
8 lot of information in there.

9 Q. Okay. Were you given directions as
10 to which pages to focus on when you started 02:56
11 reviewing the documents?

12 A. No. As a matter of fact the --
13 Lance, in his --

14 MR. YANG: Hold on a second. I want
15 to caution you not to reveal any communications. 02:56
16 The answer you gave is fine, but just don't give
17 any --

18 THE WITNESS: Okay.

19 MR. YANG: -- that's it. Don't go
20 into what we discussed in preparing for your 02:57
21 report.

22 THE WITNESS: Yeah. It was an
23 independent report. I just wanted to confirm
24 that. Didn't want to be differently -- yeah.

25 / / /

1

[REDACTED] ?

02:59

2

A. Yes.

3

4

Q. Okay. And that's independent of the
organic layers used -- strike that.

5

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

20

BY MS. ZHONG:

03:00

21

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

03:00

03:02

1

[REDACTED]

[REDACTED]

03:04

[illegible]

03:05

1

[REDACTED]

[REDACTED]

03:07

03:08

03:10

[illegible]

03:11

1

[REDACTED]

2

[REDACTED]

3

[REDACTED]

4

[REDACTED]

5

[REDACTED]

[REDACTED]

6

[REDACTED]

7

[REDACTED]

8

[REDACTED]

9

[REDACTED]

10

[REDACTED]

[REDACTED]

11

[REDACTED]

12

[REDACTED]

13

[REDACTED]

14

[REDACTED]

15

[REDACTED]

03:12

16

Q. Do you know what is the reason that

17

lithium quinolate is used in electron transport

18

layers?

19

MR. YANG: Objection.

20

THE WITNESS: So this is the -- LIQ, 03:12

21

the lithium quinolate, right?

22

BY MS. ZHONG:

23

Q. Correct.

24

A. Let me think a little bit about it.

25

The first time I saw it was used to 03:13

1 facilitate, I believe, the electron injection 03:13
2 from the cathode, but there are multiple ways to
3 use it. You could use it as single layer. You
4 can use it as a mix with another layer. You can
5 use it in mixtures with metals. And I think, 03:13
6 I'm not sure -- I think I have seen it also in
7 mixtures with HTL, with hole-transfer layers,
8 but I'm not sure. I vaguely remember that.
9 It's a very strong electron donor or acceptor,
10 rather, acceptor. 03:13

11 Q. And so have you seen lithium Q being
12 mixed with electron transport materials to
13 improve electron injection?

14 MR. YANG: Objection.

15 THE WITNESS: I don't remember very 03:14
16 top of my brain right now, my thoughts. I think
17 has been used together. I remember reading
18 reports from Yamagata University, Dr. Kido.
19 This is like in '99 or 2000 or something like
20 that. 03:14

21 Novaled did a lot of this work early
22 2000s in Germany. Yeah, so I don't know
23 exactly details if they use it in mixtures or
24 as neat but these reports are out there. We
25 can ask them. 03:14

1 BY MS. ZHONG: 03:14

2 Q. Do you know what kind of -- strike
3 that.

4 For the OLED stack, are most -- most
5 of the layers amorphous or crystalline? 03:15

6 A. I don't know. I can only tell you a
7 few things about some of the hole-transport
8 layers are very glassy, amorphous. I know from
9 my own experience in the '90s, the aluminum
10 quinolate and I would imagine other metallic 03:15
11 quinolates, they tend to be polycrystalline.
12 They tend to crystallize. So it depends on the
13 material. They take also different forms.

14 Q. Would it be better to use a more
15 crystalline form or a more amorphous form? 03:15

16 MR. YANG: Objection.

17 THE WITNESS: I think it depends,
18 right? I mean, in some cases, glassy is better
19 because it tends to act as a planarization
20 layer. 03:16

21 In the case of light emission when
22 you use them in low concentration,
23 crystallinity doesn't matter because you have
24 underneath layers. It depends on the material.

25 / / /

1 BY MS. ZHONG: 03:16

2 Q. For electron transport materials?

3 MR. YANG: Objection.

4 THE WITNESS: Again, the emission
5 layers, and I don't have the latest information 03:16

6 in my head, these days the emission layers are
7 very complex and they also use hole transport
8 layers, so -- and they are used in mixtures with
9 others, so -- I can imagine cases where you want
10 it to be amorphous. So crystallinity tends to 03:16
11 bring the molecules very close to each other and
12 the crystallinity can introduce quenching. So
13 you want to be able to control the quenching by
14 nearest neighbors.

15 But in some other cases you might 03:17
16 have performance where -- performs better when
17 it is in crystalline. So I don't know. We
18 need to -- yeah, I just don't have a lot of
19 depth on this.

20 BY MS. ZHONG: 03:17

21 Q. Isn't the case that if you want to
22 have higher electron conductivity in polymer,
23 you tend to want to have the polymer to have
24 some crystallinity?

25 MR. YANG: Objection. 03:17

1 THE WITNESS: Yeah. That's a general 03:17
2 rule, right. You cannot examine this thing in
3 isolation. You don't want to create pinholes
4 because crystallinity is introducing pinholes in
5 the structures, and pinholes are introducing 03:17
6 leaky paths. So that's why I answer it depends.
7 So you may want to blend it with amorphous
8 materials also to avoid the pinholes and the
9 leaky paths perhaps of cathode materials into
10 the emission layer. So I would -- yes. In 03:18
11 theory, crystallinity is good for transport but
12 it's not good for device fabrication.

13 BY MS. ZHONG:

14 Q. So you want to have --
15 macroscopically you want to have a more 03:18
16 amorphous or glassy material but locally you may
17 want to have a more crystalline path or
18 material; is that right?

19 A. I don't know this -- the answer to
20 this question. I was thinking more in terms of 03:18
21 leaky -- electrically leaky paths. It's a
22 complicated topic. And number one, I don't know
23 the details. Number two, you need to define the
24 boundaries, what materials we're talking about.
25 Some crystallize, some don't. 03:18

1 Q. I'm talking about electron transport 03:18
2 materials.

3 A. Yeah. But if the electron
4 transporting materials are polycrystalline.
5 Polycrystalline means pinholes and pinholes 03:19
6 means trouble, right. So I don't know how to
7 answer this.

8 Q. Do you think the addition of a metal
9 complex to the mixture would help with improving
10 the electron transport or charge transport in 03:19
11 general?

12 MR. YANG: Objection.

13 THE WITNESS: No. In one case it --
14 maybe narrow case, if the metal complex changes
15 the effective work function to the cathodes, 03:19
16 then it could improve the electron injection,
17 but it could shorten -- this is very common. It
18 could shorten a lifetime. It's very common. It
19 happens all the time.

20 BY MS. ZHONG: 03:20

21 Q. Do you know why lithium Q was
22 believed to improve the lifetime of the electron
23 transport layer into which it's mixed?

24 MR. YANG: Objection.

25 THE WITNESS: Can you repeat? You 03:20

1 said the lifetime of the electron transport 03:20
2 layer or the lifetime of the device?

3 BY MS. ZHONG:

4 Q. The lifetime of the device. Sorry.

5 MR. YANG: Objection. 03:20

6 THE WITNESS: I don't know if this is
7 general comment, I'm not so sure. What I could
8 say, and that depends also what metals you use,
9 what initial layer you use, it could help the
10 electron injection in some cases because -- 03:20

11 BY MS. ZHONG:

12 Q. Go ahead.

13 A. One of the parameters there is that
14 energetically where the energy levels are in the
15 electron transport layer that come closer to the 03:20
16 cathode, so you can inject more electrons.

17 BY MS. ZHONG:

18 Q. Why does the fact that more efficient
19 electron injection helps with lifetime
20 improvement? 03:21

21 MR. YANG: Objection.

22 THE WITNESS: Not always. There are
23 cases where you introduce these dopants and you
24 lose the lifetime in seconds.

25 In the theoretical situation, you 03:21

1 can -- in one case, let's say, you may lose the 03:21
2 lifetime because you're introducing other
3 parameters, but I can see a situation where you
4 get more electrons out so you use lower
5 voltages maybe. 03:21

6 BY MS. ZHONG:

7 Q. Can you please refresh your exhibit
8 share and see whether you see an Exhibit
9 Number 8.

10 A. Refresh. 03:21

11 (Exhibit Number 8 was marked.)

12 THE WITNESS: Yep. Well, that's
13 interesting, very interesting. It brings
14 memories of all these people.

15 BY MS. ZHONG: 03:22

16 Q. Do you see your own signature in that
17 document?

18 A. Just a moment. Is there a signature?
19 Where is my signature?

20 Q. So just for this record, Exhibit 8 is 03:22
21 a '389 invention disclosures. And it is
22 submitted as Exhibit 2006 in IPR
23 number 2024/01222. As to your signature, if you
24 go to page, PDF page 18.

25 A. You know, this is -- 03:22

1 Q. Actually, PDF page 14, I think, is 03:22
2 when it first appeared.

3 MR. YANG: Feel free to look at this
4 document if you need to familiarize yourself
5 with it. 03:23

6 THE WITNESS: Where did you guys find
7 this? Jesus. Oh, yeah.

8 BY MS. ZHONG:

9 Q. So are you at page 14 right now?

10 A. I'm at page -- I'm just admiring what 03:23
11 I see. It brings memories from this -- those
12 days.

13 Yes. Page 14 invention disclosure,
14 yes.

15 Q. Yes. And do you see that under item 03:23
16 number 11, witnessed and understood by
17 signature, is that your signature?

18 A. That's my signature.

19 Q. And if you go to PDF page number 16.
20 And on top of page 16, which says page 2 of 9, 03:23
21 the name is Homer Anton, correct?

22 A. Well, something is blurred there.

23 Q. Yeah. Looks like the middle of your
24 name got cut off or something.

25 A. Yeah. That's me. That's me. 03:24

1 Q. And then the date is October 1st, 03:24
2 2001?

3 A. Yep.

4 Q. And, also, slightly in the middle of
5 that page, there are two signatures. And one of 03:24
6 them is yours, correct?

7 A. Yes.

8 Q. The one above October 1, 2001.
9 That's your signature, is that correct?

10 A. Page again. 03:24

11 Q. Same page, page 16, PDF page 16.

12 A. Yep.

13 Q. And above that, is that Karl
14 Pichler's signature?

15 A. That's Karl's writing. I don't know 03:24
16 if it's his signature, but I remember his
17 writing.

18 Q. Why don't we go back to page 14.

19 A. Where the writeup is, yep.

20 Q. The writeup is -- in item number 6. 03:25

21 A. Yes.

22 Q. It says:

23 "Where is the invention described?"

24 And it said:

25 "Karl Pichler laboratory book 03:25

1 number 7, pages 7 and 9." 03:25

2 Correct?

3 A. That's right.

4 Q. And did you review those page numbers
5 when you signed the invention disclosure? 03:25

6 MR. YANG: Objection.

7 THE WITNESS: I don't remember. This
8 is many years ago. I remember I was remotely
9 involved. They were looking for witnesses, and
10 I had to witness this. I don't remember if I 03:25
11 reviewed the lab book or not, but typically,
12 when you're witnessing something, you're
13 witnessing either the review that they presented
14 in some kind of a document or the laboratory, a
15 book or both. You're just witnessing it, right? 03:26

16 BY MS. ZHONG:

17 Q. Can you please go to PDF page
18 number 25.

19 A. Yep. That's the document, I guess,
20 we generated. 03:26

21 Q. Does this look like something coming
22 from out of a notebook page?

23 MR. YANG: Objection.

24 THE WITNESS: I don't know if it's a
25 notebook. 03:26

1 BY MS. ZHONG: 03:26
2 Q. Okay.
3 A. I don't know 100 percent.
4 MR. YANG: Objection.
5 THE WITNESS: Yeah. 03:26
6 BY MS. ZHONG:
7 Q. So on top of it, it looks like upside
8 down, it says -- seems to be saying, Osram
9 007-1007.
10 A. This is back to 14, right. 03:27
11 Q. No. Page 25.
12 A. Page 25.
13 Q. PDF page 25.
14 A. Yeah. So what we see on page 25 is
15 the printout of the design of a passive matrix 03:27
16 display.
17 Q. Okay. And does that look like it's
18 from Osram notebook page 7, notebook 007-1007?
19 MR. YANG: Objection.
20 THE WITNESS: I don't remember that. 03:27
21 BY MS. ZHONG:
22 Q. And is that your signature on the
23 lower left-hand side?
24 A. Yes, that's my signature.
25 Q. And next to that, does that look like 03:27

1 Karl -- Dr. Pichler's yeah? 03:27

2 A. Page 8 of 9.

3 MR. YANG: Objection. I would say
4 that these are -- I'm not 100 percent sure, but
5 that's Charlie's writeup. 03:28

6 BY MS. ZHONG:

7 Q. And do you -- if you scroll to the
8 top of the page, there seems to be, like, a kind
9 of line drawn out and some writing on the top.
10 Is that also Dr. Pichler's writing or someone 03:28
11 else's writing?

12 MR. YANG: Objection.

13 THE WITNESS: This is Bates 25?

14 BY MS. ZHONG:

15 Q. Yeah. 03:28

16 A. I don't know.

17 MR. YANG: Objection.

18 THE WITNESS: I don't know.

19 BY MS. ZHONG:

20 Q. Does that look like Karl's writing 03:28
21 or --

22 MR. YANG: Objection.

23 THE WITNESS: I don't know if it's
24 Kyle's or Charlie's. I don't know.

25 / / /

1 BY MS. ZHONG: 03:28

2 Q. So when I said -- I didn't say Kyle.

3 I said Dr. Pichler's.

4 A. Sorry. Kyle Frischknecht and Karl

5 Pichler. 03:29

6 Q. Okay. So you are not sure whether

7 Dr. Pichler or Dr. Frischknecht wrote the notes

8 on the top, right?

9 A. To tell you the truth, I don't

10 remember very well this event, but Pichler seems 03:29

11 to be signing this, but I don't remember very

12 well.

13 Q. And can you scroll down to the next

14 page?

15 A. Page number. 03:29

16 Q. 26?

17 A. The handwritten page. Yeah.

18 Q. Yes. The handwritten page before two

19 figures, Figures 2 and 3, correct?

20 A. Yes. 03:30

21 Q. And you also signed this page on the

22 lower right-hand corner, correct?

23 A. Yes. That's my signature.

24 Q. And Dr. Pichler signed the page in

25 the middle? 03:30

1 MR. YANG: Objection. 03:30

2 BY MS. ZHONG:

3 Q. Like above 30 September '01, page P 9
4 of 9?

5 A. P 9 of 9, I don't know. 03:30

6 Q. Does that look like his signature?

7 A. Don't know. But those don't look
8 like lab book. These are -- lab books have
9 straight lines and boxes and stuff. Maybe this
10 is -- I don't remember this. Maybe this is 03:30
11 standalone piece of paper.

12 Q. Did these look like Dr. Pichler's
13 handwriting?

14 MR. YANG: Objection.

15 THE WITNESS: You can never be 03:31
16 100 percent. I know the signature's mine. I
17 haven't seen my signature, amazing, after all
18 these years.

19 BY MS. ZHONG:

20 Q. Do you know whose handwriting the 03:31
21 rest of the pages belong to?

22 MR. YANG: Objection.

23 THE WITNESS: Can I scan everything?

24 I mean, it's --

25 / / /

1 BY MS. ZHONG: 03:31
2 Q. Sure. Go ahead.
3 A. Again, those are all my signatures.
4 Q. Your signatures on many pages.
5 A. Yeah. I see. That's what I'm 03:31
6 scanning to see. I see that there is a notebook
7 further down.
8 Q. Where is the notebook?
9 A. All the way down, page 41. So the
10 notebook pages are 40 and 41? 03:32
11 MR. YANG: Objection.
12 THE WITNESS: Well, it -- page 40 and
13 41 appear to be out of a notebook.
14 BY MS. ZHONG:
15 Q. Okay. 03:32
16 A. But there are signatures there, I
17 don't know. There's another signature there.
18 Q. So page 40 is the one starting with
19 idea 14th August '01?
20 MR. YANG: Objection. What are you 03:32
21 pointing at here? I couldn't read this thing.
22 What are you looking at?
23 THE WITNESS: Page 40. I don't know.
24 BY MS. ZHONG:
25 Q. PDF page 40. It's a grid notebook 03:32

1 page. 03:32

2 Does this appear to be Dr. Pichler's
3 handwriting?

4 MR. YANG: Objection.

5 THE WITNESS: This is all written in 03:33
6 a hurry. If you is show me Kyle's, I will be
7 able maybe to tell the difference. But page --
8 on page -- what's that, page 14?

9 MR. YANG: You don't have to
10 speculate. 03:33

11 THE WITNESS: No. I just see a name
12 there.

13 So you have a question about this?

14 BY MS. ZHONG:

15 Q. Yeah. Do you know whose handwriting 03:33
16 this belongs to?

17 MR. YANG: Objection.

18 THE WITNESS: I mean, I see my
19 signature and I see a couple of other
20 signatures. 03:34

21 BY MS. ZHONG:

22 Q. When you say a couple of other
23 signatures, whose signature?

24 A. The notebook there is another
25 signature. 03:34

1 Q. So I see there is K. Pichler. 03:34
2 A. Page 41. I don't know who signed
3 this. I don't know this guy.
4 Q. And you think that there is another
5 signature? 03:34
6 A. I think there is another signature on
7 page 25. Sorry, sorry, not 25, 41.
8 Q. Okay. So there is one signature
9 that's dated October 1, 2001. That's yours on
10 those pages; is that right? 03:34
11 A. Yeah. I -- this notebook pages, I --
12 I mean, I don't remember any of this, but this
13 is my signature, but, you know, it's been years
14 ago. 24 years ago.
15 Q. So is it your signature on pages 40 03:35
16 and 41?
17 A. 40 and 41? 40 I don't see my
18 signature.
19 Q. So there is a date of 1/10/01 and
20 next to that is your signature somewhere? 03:35
21 A. No. Someone else's signature.
22 Q. Okay.
23 A. On the left-hand side. I don't know
24 whose signature is that.
25 Q. And you don't know whose signature is 03:35

1 it on the right-hand side? 03:35
2 A. On the right-hand side, no. Page 40
3 and page 41. Yeah, I cannot tell.
4 Q. So let's go back to page 14. The
5 signature there is yours on page 14, under item 03:36
6 11? That's yours?
7 A. 14. Yep. Just a second. It's been
8 going back and forth. 14, yes that's my
9 signature.
10 Q. And page 16, the signature above 03:36
11 October 1, 2001, that's also yours?
12 A. Yes.
13 Q. And page 18, the signature above
14 October 1, 2001 is also yours?
15 A. Yes. 03:36
16 Q. Then page 19, the signature above
17 October 1st, 2001 is also yours?
18 A. Yes.
19 Q. Same for page 20, pages 20, 21, 22,
20 and 23, the signatures above October 1, 2001 are 03:37
21 all yours?
22 A. Yes.
23 Q. No?
24 A. Yep. Yep. Page 20 and 21, this is
25 my signature October 1st, 20 and 21. 03:37

1 Q. What about 22 and 23? 03:37
2 A. Yep. 22 and 23, yes.
3 Q. Those are your signatures as well.
4 Then page 25, that's your signature as well on
5 the lower left-hand corner, right? 03:37
6 A. Yes.
7 Q. And --
8 A. Page 25, yes.
9 Q. And page 26, the signature above
10 October 1 two thousand -- above 10/1/01 is also 03:37
11 yours?
12 A. Yes.
13 Q. And then page 27, the signature on
14 the left-hand side is yours?
15 A. Yes. 03:38
16 Q. 28, the signature above 10/1/01 is
17 yours?
18 A. Mm-hmm.
19 Q. Page 30, the signature above 10/1/01
20 is yours? 03:38
21 A. 30, yes.
22 Q. Let's go to 32, the signature above
23 10/1/01 is yours?
24 A. Yes. 32. Yep.
25 Q. The same for 34. 03:38

1 notes? 03:41

2 MR. YANG: Objection.

3 THE WITNESS: I don't know. SFE

4 Technologies filed. Patent. I don't know what

5 that means. 03:41

6 I don't know. A lot of scattered

7 notes there. In one square it says "OLED also

8 device structural claims and all that."

9 BY MS. ZHONG:

10 Q. There's a note from Kyle? 03:41

11 MR. YANG: Objection.

12 THE WITNESS: I don't know. I don't

13 know. Yeah.

14 BY MS. ZHONG:

15 Q. Do you have a recollection of what 03:42

16 happened to the invention disclosure after it

17 was submitted?

18 MR. YANG: Objection.

19 THE WITNESS: Well, I'm not -- I

20 mean, basically after you're witnessing you lose 03:42

21 track of the invention, right? So if you're a

22 witness, you're witnessing all this that you

23 saw, basically you sit down together with the

24 inventor. The inventor explains, okay, this is

25 what we do here, this is what we do here, and 03:42

1 this is what we do here. 03:42

2 And then you say, okay, I understood.

3 You sign. You show understanding of what

4 they're claiming. And then it's off. I don't

5 know. After that, it moves into the filing 03:42

6 procedure. That's all I can say.

7 BY MS. ZHONG:

8 Q. And do you recall whether you were

9 the one who approved the filing of the

10 invention? 03:43

11 A. I don't remember this thing,

12 actually, tell you the truth. And probably it

13 was other people superior to me. I don't know.

14 I don't remember going through the patent

15 procedure here. This is just witnessing and -- 03:43

16 understanding, witnessing and then it went off

17 me. Which is different than the invention

18 disclosure approval. I don't remember this --

19 the invention disclosure approval process.

20 Q. So you don't remember the invention 03:43

21 disclosure approval process for this particular

22 one?

23 A. No.

24 Q. But the general process was there are

25 regularly scheduled meetings where the 03:44

1 management and the two patent attorneys 03:44
2 evaluate --

3 A. Yes.

4 Q. -- the various invention disclosures?

5 A. Usually. Usually. Often we will do 03:44
6 that, and then what you see here, and then it
7 will go into the leadership team, and they will
8 decide to accelerate it. In other words, moving
9 into the patent filing right away.

10 Q. And do you have a sense of whether 03:44
11 this one was accelerated or was put on a regular
12 track?

13 A. I don't know. I just don't remember
14 doing a detail invention disclosure approval
15 process for this. I mean, Karl -- Karl 03:44
16 presented -- I mean, we even have some common
17 patents. There was a lot of traffic at that
18 time. There's a lot of filings. Each one of us
19 had filed 10, 15 invention disclosures that then
20 moved to patent filings. It's hard to remember 03:45
21 all this.

22 Q. When you say like each of you filed
23 10 to 15 invention disclosures, you mean like
24 per year, per month --

25 A. No. Over the course of five, 03:45

1 six years for me. 03:45

2 Q. Do you know how many invention
3 disclosures Kyle filed within his two years'
4 tenure at Osram?

5 MR. YANG: Objection. 03:45

6 THE WITNESS: I don't remember very
7 well. I have one joint patent with him or two.

8 BY MS. ZHONG:

9 Q. Can you please take a look at
10 page 14, item number 7. 03:45

11 A. Yes. Give me some time to read.

12 Q. Sure.

13 A. I read it.

14 Q. Do you see that in item number 7,
15 Dr. Pichler said that he had been carrying 03:47
16 around part of the invention for a long time,
17 greater than one year and the first written
18 description was in an internal email dated
19 February 8th, 2001 to Dr. Frischknecht?

20 A. Yeah. I read that. 03:47

21 Q. Why don't you go back to PDF page 1
22 and read to yourself the email exchange between
23 Dr. Karl Pichler and Dr. Kyle Frischknecht?

24 A. This is February 8th. I see. This
25 is -- 03:48

1 Q. This is the email referenced in the 03:48
2 invention disclosure, correct?

3 MR. YANG: Hold on a second.

4 Objection. Calls for speculation.

5 THE WITNESS: I'm just reading the 03:48
6 email. I don't know what it is. I need to read
7 it. Page 1, right?

8 BY MS. ZHONG:

9 Q. Correct.

10 A. Let me read it. I don't know where 03:48
11 it is.

12 Q. Let me know when you're done
13 reviewing it.

14 A. Yeah. I'm just intentionally slow to
15 make sure that I read it. 03:50

16 Q. That's fine. Take your time.

17 A. Yeah. I mean, every laboratory those
18 days were thinking about thin film encapsulation
19 and that's some ideas about thin film
20 encapsulation. Everybody was working on thin 03:50
21 film encapsulation at that time.

22 Just the first part of it, right, or
23 also everything?

24 Q. Why don't you read everything.

25 A. Yeah. 03:52

1 Q. So the subject matter of the email 03:52
2 exchange concerns the thin film encapsulation
3 structure.

4 A. I read the one that you're -- yeah.
5 Okay. Charlie is that type of person. I 03:52
6 haven't seen the very first page. That's the
7 first time I think I see it.

8 Q. When you say Charlie is that type of
9 person --

10 A. Dr. Pichler. 03:53

11 Q. When you say Dr. Pichler is that type
12 of person, what exactly do you mean?

13 A. Like he's thorough.

14 Q. And let's start from the bottom since
15 that's the chronological order. So at the 03:53
16 bottom of the email Dr. Pichler mentioned some
17 of his work at FED bracket eMagin?

18 A. eMagin, yeah.

19 Q. Do you see that?

20 A. Yeah. 03:53

21 Q. And he mentioned in addition to PML,
22 he mentioned an LML structure.

23 Do you see that?

24 A. Yes. I don't know what that thing
25 is. 03:53

1 Q. And he says: 03:53
2 "And stressed that LML, comma, i.e.,
3 spinning in inert conditions a carefully
4 outgassed cross-linkable solution onto the
5 8 inch wafers with subsequent cross 03:53
6 linking and barrier layer sputtering."
7 Do you see that description of the
8 process?
9 A. Yes. To be perfectly feasible.
10 Q. So spinning refers to spin coating in 03:54
11 this context, correct?
12 MR. YANG: Objection. Calls for
13 speculation.
14 THE WITNESS: Let me just read it
15 once more. And subsequent cross-linking. In 03:54
16 some cases spinning refers to spin coating.
17 BY MS. ZHONG:
18 Q. Is spin coating --
19 A. Spinning the wafer I think it means
20 here. 03:54
21 Q. When they talk about spinning the
22 wafer, it's probably talking about spin coating
23 the wafer; is that correct?
24 A. Maybe. I don't know.
25 Q. And if you look at the response from 03:54

1 Dr. Frischknecht to Dr. Pichler, he said: 03:54
2 "I have also previously considered
3 spin coating the acrylate layer."
4 Do you see that?
5 A. Yes. 03:55
6 Q. So does that indicate to you that
7 when Dr. Pichler was talking about spinning,
8 he's referring to spin coating?
9 MR. YANG: Objection.
10 THE WITNESS: I don't know 03:55
11 100 percent. Maybe.
12 BY MS. ZHONG:
13 Q. It's a reasonable interpretation,
14 correct?
15 MR. YANG: Objection. 03:55
16 THE WITNESS: I don't know.
17 BY MS. ZHONG:
18 Q. Is spin coating a selective
19 deposition technique or it's a blanket
20 deposition technique? 03:55
21 MR. YANG: Objection.
22 THE WITNESS: It depends what you
23 have under the spin coating process. It can
24 turn out to be something selective if you lift
25 off the materials underneath. 03:55

1 BY MS. ZHONG: 03:55

2 Q. When you --

3 A. It's reducing an extra step. So if
4 you have something spin coatable that is
5 intractable on top of an area that is soluble, 03:56
6 you can dissolve it and it will give you the
7 area that is intractable.

8 BY MS. ZHONG:

9 Q. But when you first spin coat it, it's
10 coated everywhere, it's not -- the material is 03:56
11 not deposited only at selected areas; is that
12 correct?

13 A. When you spin it, yes, it will coat
14 the whole wafer.

15 Q. So when you're spin coating a wafer, 03:56
16 it is -- that process of applying the solution
17 or whatever the material, that particular step
18 is nonselective or a blanket deposition step?

19 MR. YANG: Objection.

20 THE WITNESS: In a bare wafer when 03:56
21 you take -- when you add a material in the case
22 of bare wafer, that you drop in, let's say, a
23 photoresistor, any material that is curable, it
24 will coat the entire wafer upon spinning.

25 / / /

1 BY MS. ZHONG: 03:57

2 Q. So, for example, it will coat the
3 electrical pins that's on the wafer.

4 A. Sorry, come again?

5 Q. Electrical pins. 03:57

6 A. It will coat the -- it will coat --
7 if you spin a droplet of material, it will
8 coat -- in most cases, the majority of the
9 surface.

10 Q. And it will cover, for example, 03:57
11 electrical contacts scribe lines, if there are
12 scribe lines on the wafers, correct?

13 MR. YANG: Objection.

14 THE WITNESS: It will coat any
15 material that is underneath. Not 100 percent, 03:57
16 but it could coat material that's underneath.

17 BY MS. ZHONG:

18 Q. So the spin coating, there isn't
19 really a way for you to coat only targeted
20 areas? 03:58

21 MR. YANG: Objection.

22 THE WITNESS: It will be hard to do
23 that. You have to put partitions and the like
24 and barriers, modes.

25 / / /

1 BY MS. ZHONG: 03:58

2 Q. That's usually not how people do spin

3 coating?

4 MR. YANG: Objection.

5 THE WITNESS: If you don't use the 03:58

6 obstacles, it will coat the area. Not

7 necessarily uniformly but it will coat it.

8 BY MS. ZHONG:

9 Q. Now, Dr. Frischknecht mentioned that:

10 "It very well may be that a vapor 03:59

11 deposition or a shadow mask is the easiest

12 method for producing an array of small

13 displays on a large plate of glass."

14 Do you see that?

15 MR. YANG: Which line is this? 03:59

16 MS. ZHONG: In the second email in

17 the chain.

18 MR. YANG: Which line?

19 MS. ZHONG: Starting with -- I think

20 the sixth line, starting with "although." 03:59

21 THE WITNESS: Although.

22 Yeah, I read that sentence.

23 BY MS. ZHONG:

24 Q. And why don't you read that whole

25 paragraph to yourself, again, just to get 03:59

1 context. 04:00

2 A. Yeah.

3 Q. So here Dr. Frischknecht is proposing

4 ways to deposit an acrylate layer in this -- in

5 selected areas to keep the electrical pins free 04:00

6 of the coating; is that correct?

7 MR. YANG: Objection.

8 THE WITNESS: He's also proposing

9 ways to mask the areas that require uncovering.

10 Like you could put tape. You can put things 04:00

11 like that. Yeah. Considering everything here,

12 that's what I see.

13 BY MS. ZHONG:

14 Q. So one of the ways to keep the

15 electrical pins free of the coating is to use 04:01

16 shadow mask?

17 A. That's what he's describing here.

18 Q. Yeah. Another way he proposed is

19 inkjet printing?

20 A. Yeah. This is -- these are 04:01

21 techniques that also are used for OLED

22 deposition to, you know, avoid subtractive steps

23 like the masking step or the etching step.

24 Q. But in the context here it's

25 specifically talking about the PML structures, 04:01

1 correct? 04:01

2 A. Mm-hmm. Yep. Yeah. The polymer
3 multilayer, yeah.

4 Q. Okay. And then, Doctor -- in the
5 topmost email chain, Dr. Pichler suggested that 04:01
6 after you form the -- selectively deposited the
7 organic layer, you can deposit a dielectric
8 barrier layer through a mask over the OLED area
9 only, correct?

10 MR. YANG: Objection. 04:02

11 THE WITNESS: Let's read it again.

12 BY MS. ZHONG:

13 Q. The topmost one.

14 A. Yeah. I'm looking. Which line are
15 you looking to this? I read it. 04:02

16 Q. The second sentence.

17 A. Yep.

18 Q. So what he wanted to do is basically
19 to deposit the barrier layer also in the
20 selective area to keep the contact pads, scribe 04:03
21 lines, et cetera free from the barrier layer?

22 MR. YANG: Hold on a second. Hold
23 on. Objection.

24 You can go ahead and answer.

25 THE WITNESS: So let me just read it 04:03

1 carefully. It says: "Spin-, roll- or 04:03
2 whatever-coat... through a mask of the OLED
3 area."

4 I don't understand some of the --
5 "stick the whole thing in." Oh, I see. Got 04:03
6 it.

7 BY MS. ZHONG:

8 Q. So basically he's suggesting a
9 selective deposition of the dielectric barrier
10 layers through a mask, correct? 04:04

11 MR. YANG: Objection.

12 THE WITNESS: He's suggesting a
13 masking that I see followed by a plasma asher
14 and ash-off the organics.

15 BY MS. ZHONG: 04:04

16 Q. And the masking -- so the mask is
17 basically to make sure that the barrier layers
18 is going to be deposited in the openings of the
19 mask?

20 A. Can you repeat again, please. 04:04

21 Q. What's the reason for use a mask --
22 for using a mask?

23 A. So the idea here is to free up the
24 metallic regions so you can access them
25 electrically, right? So I think the thing here 04:04

1 is -- the Osram team is proposing a process of 04:04
2 how to reduce the processing steps on the thin
3 film encapsulation device. Right.

4 Q. So the idea is trying to deposit the
5 barrier layer and the organic layer only where 04:05
6 they are needed to keep the contact pad, the
7 scribe lines free of materials; is that correct?

8 MR. YANG: Objection.

9 THE WITNESS: So to operate the
10 device you need to have an easy access to the 04:05
11 metal leads.

12 BY MS. ZHONG:

13 Q. Uh-hmm.

14 A. These metal leads cannot have an
15 organic compound on them or an inorganic 04:05
16 compound on them.

17 So cleaning up this areas requires
18 extra processing steps or requires tapes and the
19 like, if you do spin coating then you have to
20 peel off the tape, right? So based on my 04:05
21 recollection, the motivation there is to take
22 the PML process from -- at that time, you know,
23 John Affinito who works -- who used to work for
24 Battelle. I don't know if he joined Vitex or
25 not, but that's how the whole thing started. 04:06

1 Everybody was talking to Battelle at the time. 04:06
2 So the question is how do you protect the metal
3 areas.

4 So based on my assessment here, by
5 reading this, and what I remember, is how do you 04:06
6 reduce the processing steps of the thin film
7 encapsulation, the technology basically that
8 came, it was public at that time, through the
9 John Affinito work at Battelle and through the
10 Vitex. 04:06

11 So -- and what both Karl and Kyle are
12 describing here is methods to reduce the
13 processing steps for a thin film encapsulation.
14 That's a way of protecting -- not protecting but
15 freeing up the metal lines. That was the 04:07
16 motivation. These guys were experts in thin
17 film encapsulation.

18 Sorry. I'm thinking, because I'm
19 calling him, Charlie. Pichler came from eMagin.
20 eMagin was working already on thin film 04:07
21 encapsulation. So they were talking to Affinito
22 because Affinito was talking to everybody.

23 So Karl Pichler, he knew what it
24 takes to make this thin film encapsulation
25 device. I think the new thing which, you know, 04:08

1 I mean, you want to access the metals. You need 04:08
2 to protect the metals from organics. So either
3 you have to mask it or you have to not print it,
4 right? So that's the -- the concept here behind
5 this, I would say, documentation that I 04:08
6 witnessed.

7 Q. Okay. And do you know how much
8 savings in processing costs or throughput time
9 this selective deposition technique would save
10 versus the old technique of blanket coating then 04:08
11 kind of a remove the materials from the metal?

12 A. I don't know.

13 MR. YANG: Hold on. Objection.

14 THE WITNESS: It's extra processing
15 steps. I don't know what it will cost. This 04:08
16 process of cleaning up the metals has been
17 described also by eMagin and FED. Used to be
18 called FED. So these guys were pursuing this.

19 And anyway, the, as you call it,
20 selective technology, it's standard in the 04:09
21 semiconductor industry for a single layer.
22 Let's say an inorganic barrier, it's a standard
23 best-known method for encapsulating
24 semiconductors.

25 And I remember seeing patents from 04:09

1 Motorola that use thin film encapsulation, not 04:09
2 necessarily the PML way 'a la Vitex, but the
3 idea of using oxides or nitrides or things of
4 that sort for protecting the semiconductors, it
5 was known all along. And keeping the pads 04:10
6 uncoated from nitride, you know. I mean, of
7 course, you want to keep the metal uncovered
8 because you -- yes, you can cover it, but then
9 you have to introduce another step.

10 So the -- I think the new thing here 04:10
11 is the fact that you avoid coating the metal
12 areas with masking or with printing
13 technologies, right.

14 BY MS. ZHONG:

15 Q. And in the Motorola one, did they 04:10
16 have an organic layer?

17 A. Sorry, come again?

18 Q. You mentioned the Motorola one, you
19 mentioned the Motorola coating technology which
20 I assume was not for OLED, but... 04:10

21 A. No. It was OLED. '95, actually,
22 because Motorola was working on this for a long
23 time. It's one of the very first patents of
24 thin film encapsulation.

25 Now, organic, I don't remember if 04:11

1 they have an organic layer, but if you take, 04:11
2 let's say, the Motorola patent and the Battelle
3 patent from John Affinito and Battelle and the
4 eMagin patent, this is all prior art, right?

5 But -- and then the Affinito 04:11
6 technology became Vitex. Everybody was active
7 discussing these things at that time. The
8 question is how do we take this thing into a
9 practical manufacturable process.

10 So cleaning up the pads and the metal 04:11
11 lines, it's -- it's key to this technology,
12 right? You don't want to have the metal with --
13 with organics or with inorganics. This is not
14 all that specific. This is true for every chip
15 that is built on a wafer that's a DRAM or CMOS 04:11
16 sensors. They leave always the pads uncovered
17 and they do this thing with an additional
18 etching step or masking step, right.
19 Photolithography masking.

20 So I think that this technology here 04:12
21 that Pichler and Frischknecht are describing,
22 it's similar to that but more specific to OLEDs.

23 Q. But their idea is trying to avoid
24 having to do a liftoff or etching process to
25 open up the metal lines, correct? 04:12

1 MR. YANG: Hold on. Objection. 04:12

2 THE WITNESS: Both Pichler and
3 Frischknecht were very familiar of the PML
4 process, right. I probably forgot that Pichler
5 also is describing that eMagin also was working 04:12
6 on it, right? So it's their effort to innovate
7 in this crowded space by approaching it with the
8 cleaning of the metal lines.

9 BY MS. ZHONG:

10 Q. They're trying to avoid having to 04:13
11 clean metal lines, correct?

12 A. I think there's one page there where
13 this thing's described. The one that had the
14 pixelated display. Yeah, page 25. You can see
15 on the right-hand side there are tons of 04:13
16 horizontal lines. So these are metallic lines.

17 Q. Okay.

18 A. You want to keep them metallic. So
19 they're describing way of avoiding the PML to
20 coat the entire thing. 04:14

21 Q. So they are trying to find a way when
22 you deposit the organic and inorganic material,
23 those materials will avoid the metallic regions;
24 is that correct?

25 MR. YANG: Objection. 04:14

1 THE WITNESS: Well, I mean. 04:14
2 MR. YANG: Hold on. Objection.
3 THE WITNESS: The way I understand
4 it, by reading this, is that they're focusing
5 primarily on how to keep the metal lines free of 04:14
6 the inorganic and the organics.
7 BY MS. ZHONG:
8 Q. During that --
9 A. Sorry.
10 Q. And to avoid the metal lines free of 04:14
11 the organics and inorganics during deposition?
12 MR. YANG: Objection.
13 THE WITNESS: Well, they're also
14 talking about masking, right? So with other
15 words, if you UV cure the organic layer and 04:14
16 you're on top of the metal, it would be
17 difficult to clean it, so you have to mask it.
18 So they're discussing multiple things here,
19 right?
20 For example, I think Kyle says the 04:15
21 inkjet printing is also challenging. By the
22 way, none of this was happening in practice
23 in -- at work. This is all theoretical
24 proposals. We didn't have experience in any of
25 this, hands-on experience. We were just 04:15

1 proposing things. 04:15

2 For example, Karl -- Kyle was saying
3 you can use masking and masking may be more
4 efficient than printing because we know how to
5 do it. So -- please. 04:15

6 BY MS. ZHONG:

7 Q. Go ahead. Go ahead.

8 A. My understanding is that -- and I'm
9 recollecting what was happening there, we knew
10 that TFE was proposed by -- particularly 04:15
11 Vitex/Battelle technology. The question is at
12 that time what was public was that the thin film
13 encapsulation pioneered by Battelle was -- and
14 Vitex, it was done by some kind of a coating
15 through -- in a chamber. 04:16

16 Of course these guys moved on and
17 they made improvements. I'm just not aware of
18 the improvements. So this is a rebuttal or an
19 improvement, maybe, of how to avoid coating the
20 metal lines. That's all. That's how I read it. 04:16

21 Q. Okay.

22 A. Unfortunately we didn't reduce this
23 thing to practice. We didn't have a thin film
24 encapsulation tool.

25 Q. Okay. And you mentioned that at the 04:16

1 time, Dr. Frischknecht was working on 04:16
2 encapsulation of the OLED devices?

3 A. Yes.

4 Q. What else was he working on?

5 A. He was working on glass-glass 04:17
6 encapsulation. Glass-glass encapsulation was
7 the best-known method at that time that we were
8 using.

9 Q. Understood. But what else was he
10 working on besides the encapsulation project? 04:17

11 A. I think he was very focused on this
12 encapsulation because we had some serious issues
13 that we had to address. It was not a slam dunk
14 to do glass-glass. The thin film encapsulation
15 was one of his activities after the glass-glass, 04:17
16 the number two, you could say, activity.

17 Q. So it is a long-term project compared
18 to the glass-glass approach?

19 MR. YANG: Objection.

20 THE WITNESS: I know he spent a 04:17
21 little bit less time or a lot less on the thin
22 film versus the glass-glass. I mean, we had
23 serious topics to address on the glass-glass.
24 The glass-glass was not trivial.

25 / / /

1 BY MS. ZHONG: 04:18

2 Q. Understood.

3 So was he working on both the thin

4 film encapsulation and the glass-glass in

5 parallel but devoting more time and energy to 04:18

6 the glass-glass?

7 A. The glass-glass -- the glass-glass

8 was hands-on in the lab using his hands and his

9 brain. The thin film encapsulation was all

10 papers, reading and brainstorming and ideas and 04:18

11 talking to people.

12 Q. Okay. But you know that -- was he

13 like working on it relatively continuously while

14 he was also working on the glass-glass

15 encapsulation in the lab? 04:18

16 MR. YANG: Objection.

17 THE WITNESS: Not continuously. On

18 and off. It was a secondary activity.

19 BY MS. ZHONG:

20 Q. Based on his -- what's happening in 04:18

21 the glass-glass project deadlines and all that?

22 A. On and off. It was -- thin film

23 encapsulation was not ready for mass production.

24 No one was doing thin film encapsulation at that

25 time in manufacturing. 04:19

1 Q. So when you say it's on and off, it's 04:19
2 not like he abandoned the idea, but it's more he
3 was trying to find time to work on it when the
4 glass-glass encapsulation project allows him to
5 do that? 04:19

6 MR. YANG: Objection.

7 THE WITNESS: So let me step back a
8 little bit. We had R&D activities on many
9 programs. Thin film encapsulation, flexible
10 substrate, full-color inkjet printing, full 04:19
11 color means RGB full-color displays. Those were
12 secondary projects.

13 The most important project for all of
14 us was to help the manufacturing to introduce
15 the products in the market. And introducing 04:19
16 the products in the market was very stressful
17 for all of us. So encapsulation and the
18 performance of the displays under certain
19 testing conditions had to be met. So very
20 frequently, many of us will stop everything we 04:20
21 were doing and we would focus on this.

22 BY MS. ZHONG:

23 Q. Okay. So when you said thin film
24 encapsulation project, the inkjet project and
25 several other projects, were they for the period 04:20

1 between February 2001 and middle of 2002? When 04:20
2 were those projects? Were they --

3 A. Yeah. Very early on. Further down
4 the road it became apparent to us that we had to
5 support manufacturing, so we became more applied 04:20
6 to basically deliver the passive matrix
7 displays. We didn't do much with flexible.
8 So --

9 Q. But early in the period of like early
10 2001 to mid-2002, those R&D projects were 04:20
11 ongoing with more focus on trying to get out a
12 commercial product; is that correct?

13 MR. YANG: Objection.

14 THE WITNESS: We would spend much
15 more time on the product development than the 04:21
16 R&D, this team in particular.

17 BY MS. ZHONG:

18 Q. And was part of the effort also
19 trying to make a commercially viable OLED device
20 in the first instance? 04:21

21 A. Commercially viable based on
22 glass-glass encapsulation. Imagine that this --
23 every processing steps those days in the OLED
24 industry didn't have dedicated tools. So we had
25 to work with the right vendors to develop the 04:21

1 tools. So working with the glass-glass 04:21
2 encapsulation vendor, it took a lot of effort
3 and a lot of activity. So it would consume
4 basically the time of many of us. I was working
5 testing at that time, to test all these 04:22
6 displays. So the reason --

7 Q. What about the -- sorry. Go ahead.

8 A. I just wanted to say a thin film
9 encapsulation didn't happen for another
10 10 years. 04:22

11 Q. I understand that.

12 But in -- even for glass-glass
13 encapsulation, you have to have an OLED device
14 before you can encapsulate it, right?

15 A. Yes, of course. 04:22

16 Q. So were there also efforts building
17 the or fabricating the OLED devices themselves?

18 A. Yes. We did both in San Jose as well
19 as in Penang.

20 Q. And was -- what doctor -- no. Was 04:22
21 Dr. Pichler involved in fabricating the OLED
22 devices?

23 A. I don't recall all the projects that
24 he worked because he was a senior experienced
25 individual. I know at the beginning that he 04:22

1 Q. And were you talking to 04:24

2 Dr. Affinio -- Affinos --

3 A. Affinito. John Affinito is a
4 scientist at Battelle. They had a roll-to-roll
5 coater there that is not applicable to OLEDs. 04:24
6 So the whole idea of Vitex is to take this
7 technology and convert it to a rigid glass
8 substrate and develop it.

9 Q. I thought there were projects to do
10 roll-to-roll for the OLEDs at the time. 04:24

11 MR. YANG: Hold on. Objection.

12 THE WITNESS: It's -- roll to roll
13 it's -- it's a holy grail for the field. Even
14 now it's not happening. So, yes, I can go back
15 to '95 and I can tell you that I had colleagues 04:24
16 that believed in '97 it would be ready, but now
17 we are 2025 and it's still not real.

18 BY MS. ZHONG:

19 Q. What was the challenge for the roll
20 to roll? 04:25

21 A. Well, many challenges. It could take
22 us a whole day to talk about the challenges.
23 Geometrical variability in the -- in the way
24 that the flexible materials behave. Particle
25 generation. 04:25

1 Since we're talking about flexible, 04:25
2 the most reliable way to do flexible is to use a
3 flexible material substrate on the rigid glass.
4 Build your OLED on the rigid glass and then peel
5 off this substrate with the OLED on it, with the 04:25
6 thin film encapsulation on it and then cut it to
7 displays, and this is yet another area that the
8 industry has progressed by using flexible
9 displays. And the technology was pioneered by
10 Samsung Display corporation. 04:26

11 That's the only way that today's
12 viable to use flexible and -- yeah, it's -- as
13 we discussed earlier this morning, you can only
14 use glass-glass to this. Right. So thin film
15 encapsulation. But at that time -- it's 04:26
16 interesting. Up to 2015 or '14, the thin film
17 encapsulation, no one knew how to do it. There
18 was only one group that knew how to do this.

19 Q. When you say there's only one group
20 who would have knew how to do -- 04:26

21 A. On the large panels, right.

22 Q. Which group was that?

23 A. Samsung. So, for instance, I can
24 refer to the eMagin. They have IP on this.
25 But, you know, eMagin was doing everything, or 04:27

1 FED, they were doing everything on substrates, 04:27
2 on silicon substrates. So this approach of
3 doing thin film encapsulation on silicon
4 substrate was kind of known. Based on what I
5 view using shadow masks and the like, this is 04:27
6 how encapsulation -- thin film encapsulation is
7 done in ICs, right, sensors and the like.

8 So that's why eMagin was able to jump
9 into this and do it faster. Right. Doing it in
10 very large area, it requires a lot of management 04:27
11 on particles, on uniform use of the film.

12 It's -- the most important thing is really the
13 particle management. How do you bury the -- how
14 do you don't generate particles, number one?

15 Then if you have particle generation, either in 04:28
16 the substrate or during the process, how do you
17 bury them so they don't affect the device.

18 That's basically what enabled the
19 manufacturability of the thin film encapsulation
20 in mass production. And now everybody's doing 04:28
21 it.

22 Q. For the roll-to-roll process for thin
23 film encapsulation, can you deposit the
24 inorganic barrier layers selectively in only
25 certain regions? 04:29

1 A. I don't know and I don't remember. 04:29
2 This is a crowded space. GE had an activity on
3 this. 3M had an activity on this. General
4 Atomics had an activity on this. And many
5 others. 04:29
6 So for capacitors you need to take
7 care of the areas where you're contacting the
8 capacitor. So you need to free up the contacts.
9 It's almost obvious that you need to somehow
10 access the patents, right? I'm sorry, the 04:30
11 contacts. So I don't know if supercapacitors
12 did that, but originally, that's how the PML was
13 used, if I remember correctly. This is many
14 years ago.
15 Q. But PML -- I mean, supercapacitor 04:30
16 structure and the OLED structures are very
17 different?
18 A. Correct. But the capacitors also
19 have two leads. So you need to respect the
20 leads. So I don't know that, but I could maybe 04:30
21 imagine that they develop areas to protect the
22 contacts.
23 Q. So if you take a look at Exhibit
24 Number 6, which is a Kateeva presentation and go
25 to page 20. 04:31

1 So presenting the potential technology would 04:32
2 attract investors to invest. Very different
3 from what, let's say, Osram or HP will do that
4 have already funding.

5 Roll-to-roll, the application of TFE 04:32
6 with inkjet printing or roll-to-roll never took
7 place. No one did this.

8 Q. Understood.

9 But I just want to ask your opinion
10 on the second bullet point. Is it true that: 04:32

11 "For the inorganic layer the only
12 option in roll-to-roll is blanket coating
13 followed by removal material at the end of
14 the process"?

15 A. I don't know if that's true. If you 04:33
16 look at, for instance, the eMagin patents on
17 thin film encapsulation, they have masks that
18 they're using to put in organic layer. And I
19 don't know if there is other work that has been
20 done. Need to also look more carefully at the 04:33
21 Motorola patents. So I don't agree with that
22 bullet point.

23 Q. What about for OLED? Do you agree
24 with that?

25 MR. YANG: Objection. 04:33

1 THE WITNESS: Well, you can use a 04:33
2 stencil mask. The same way you do fine metal
3 mask, you can do the same thing with a flexible
4 substrate in the chamber and protect the
5 majority of the metals. I don't agree with 04:33
6 this.

7 BY MS. ZHONG:

8 Q. Okay. Can you use that with the
9 roll-to-roll process using a mask?

10 A. I don't know for a fact but I would 04:34
11 imagine so. I mean, printing technology works
12 like that. Flexo printing is like this. Flexo
13 printing that prints on T-shirts and stuff like
14 that, they're all done with -- analogous to this
15 and you do the ink in selective areas that you 04:34
16 want the Flexo printing to go to. So in theory,
17 stencil, it can be done like this. Screen
18 printing works with a mask and it works on
19 flexible substrates. Sure.

20 Q. Do you know whether anyone has 04:34
21 actually done that?

22 A. So I don't know. I don't know -- I
23 mean, there are so many things I have done out
24 there. I'm not aware of any -- if you're -- if
25 you are referring to OLEDs, I'm not aware of any 04:35

1 OLED roll-to-roll process that is in mass 04:35
2 production today.

3 Q. What about just in pilot?

4 A. I'm not aware of any in pilot
5 roll-to-roll OLED line. 04:35

6 Q. What about just on the curiosity?

7 MR. YANG: Objection.

8 THE WITNESS: I don't know. R&D can
9 be just a really small line that doesn't really
10 mean much. 04:35

11 MS. ZHONG: Why don't we take a
12 10-minute break.

13 MR. YANG: Sounds good.

14 THE VIDEOGRAPHER: Off the record at
15 4:35 p.m. 04:35

16 MS. ZHONG: Can I get a time count
17 from the court reporter or the videographer.

18 (Recess.)

19 THE VIDEOGRAPHER: We are back on the
20 record at 5:03 p.m. 05:03

21 BY MS. ZHONG:

22 Q. Welcome back, Doctor.

23 So we discussed the invention
24 disclosure and the pages where you signed your
25 names. Do you remember -- recall that 05:03

1 discussion? 05:03

2 A. Yes. From the last session.

3 Q. Okay. So for the pages that you have
4 signed -- on which you have signed your names,
5 did you review the content on those pages before 05:03
6 you signed your names?

7 MR. YANG: Objection.

8 THE WITNESS: As I shared with you
9 earlier, it has been a long time. I barely
10 remember signing some of these things. So -- 05:03
11 but these are my signatures.

12 BY MS. ZHONG:

13 Q. Okay. What was your general practice
14 when you signed those documents?

15 MR. YANG: Objection. 05:03

16 THE WITNESS: We didn't have a fixed
17 practice. In some cases, we will do a formal
18 review as a committee. In some other cases we
19 will do it in a hurry. So I don't know about
20 this case. I don't remember very well. It's 05:04
21 24 years.

22 BY MS. ZHONG:

23 Q. But do you recall reviewing the
24 contents of the document before you signed it?

25 MR. YANG: Objection. 05:04

1 THE WITNESS: I remember the topic 05:04
2 discussed and thin film encapsulation was one of
3 the R&D topics.

4 BY MS. ZHONG:

5 Q. So you recall discussing the topic 05:04
6 with Dr. Pichler at least?

7 MR. YANG: Objection.

8 THE WITNESS: For instance, I
9 remember now after seeing this that Karl Pichler
10 disclosed to us that he has seen similar 05:04
11 approaches at FED Corporation, eMagin
12 Corporation, and I had forgotten this. And now
13 seeing it, he was the guy that would disclose
14 whatever he had in his mind. And I'm surprised
15 to see this thing referring to the -- this way 05:05
16 of doing thin film encapsulation as a way of
17 protecting the metals.

18 And he has told everybody -- I think
19 that's the patent that we're talking about
20 here, right? 05:05

21 BY MS. ZHONG:

22 Q. Can we go to page 14 of the eMagin
23 disclosure.

24 A. Yes.

25 Q. And do you see that in item number 7 05:05

1 he said he had been carrying around part of the 05:06
2 invention for a long time, greater than one
3 year?

4 Do you see that?

5 A. Yeah. 05:06

6 Q. So this document was signed on
7 September 30, 2001, correct, by him?

8 A. Yes.

9 Q. If you look at the signature at the
10 date right above item number 4. 05:06

11 A. Let me see it so I can confirm.

12 Yes, September 30th, 2001, yes.

13 Q. And Dr. Pichler started in spring
14 2000 at Osram, correct?

15 MR. YANG: Objection. 05:06

16 THE WITNESS: I don't remember the
17 exact date. He joined after I joined.

18 BY MS. ZHONG:

19 Q. But it would be in 2000, spring 2000?

20 A. I don't know the exact date. 05:07

21 Q. Would it be 2000?

22 A. I think so, but I don't remember
23 exactly when.

24 Q. Do you remember whether it's the
25 first half or the second half of 2000? 05:07

1 A. What comes to my mind is the middle 05:07
2 of the year, somewhere around that time. I
3 don't know exactly. I don't remember exactly.

4 Q. So when he says it has been -- he has
5 been carrying around the invention for over a 05:07
6 year, that would be after he joined Osram,
7 correct?

8 MR. YANG: Objection.

9 THE WITNESS: I don't know. No.
10 Just a little bit of background for Karl 05:07
11 Pichler, he worked for CDT, Cambridge Display
12 Technology. I'm sure they talked about thin
13 film encapsulation there. He also worked for
14 FED Corporation, then eMagin, and these guys are
15 exercising thin film encapsulation in 05:07
16 production.

17 So that's all the -- plus all the
18 interaction with PML technology from Affinito
19 and Battelle. I don't know what he means by
20 the words "carrying around" if it is knowledge 05:08
21 from his previous work or something else.

22 BY MS. ZHONG:

23 Q. Did you ask him when you first
24 reviewed this?

25 A. Well, I don't remember, to tell you 05:08

1 the truth, but how this was furnished to me, it 05:08
2 was as a way of reducing the processing steps in
3 protecting the metal contacts.

4 Q. When you said protecting the metal
5 contacts, you mean keeping it free from the 05:08
6 deposit of organic and inorganic?

7 A. These are all the ideas that I think
8 that's what he means. How to -- methods for
9 allowing the contacts to stay uncovered after
10 you do thin film encapsulation with the minimum 05:09
11 number of steps. That's what I think he's
12 saying.

13 Q. And is CDT the same company as eMagin
14 or it's a different company?

15 A. Totally different. 05:09

16 Q. And did Kyle -- I mean Dr. Pichler
17 work for CDT after eMagin or before or do you
18 know?

19 A. He worked for first at CDT after
20 graduate school, and then he went, I think, to 05:09
21 FED, eMagin. Changed the name. And then he
22 came to us.

23 Q. And when you read this invention
24 disclosure, if you had thought that Dr. Pichler
25 conceived any part of the invention while he was 05:10

1 not at Osram, would you have raised that as a 05:10
2 red flag?

3 MR. YANG: Objection.

4 THE WITNESS: Let me say something
5 else. I -- only became aware of the eMagin 05:10
6 patents recently, and all I knew those days is
7 that eMagin is working on some kind of a thin
8 film encapsulation and they would brag that they
9 don't need the Vitex technology. I remember
10 that from here and say, no, this is already 05:10
11 there.

12 BY MS. ZHONG:

13 Q. When you read the invention
14 disclosure did Dr. Pichler tell you that the
15 idea was not all his or Dr. Frischknecht or 05:11
16 someone else?

17 A. They're disclosing that a lot of this
18 work has been done elsewhere already on this
19 disclosure after reading it. By allowing me to
20 read this it came to my mind that they were 05:11
21 trying to find ways to innovate patentable
22 ideas, right? So the methods that they
23 proposed, they revolve around freeing up the
24 metal contacts from organics in the most
25 economical way. That's the crux of this 05:11

1 invention disclosure. 05:11

2 And that's what I remember
3 discussing. Neither Karl or Kyle came to me.
4 Well, I think it was Pichler came to me claiming
5 thin film encapsulation. We were all worrying 05:12
6 about how we're going to protect the metal pads
7 or at least leave them uncovered, and we were
8 sensitive to this because when you use soluble
9 materials, you always have this problem.

10 Q. And did either Dr. Frischknecht or 05:12
11 Dr. Pichler tell you that FED or eMagin was
12 already doing selective deposition to leave the
13 metal contacts or scribe lines open or free of
14 the materials?

15 A. I don't remember very well. So the 05:12
16 only information that we had at that time is
17 what's written in the emails. If you look at
18 page 1, it just came to my mind, I vaguely
19 remember reading this page 1 at the bottom. As
20 you can see, I am in the "to." So when Charlie 05:13
21 worked for eMagin, Pichler, he saw a certain way
22 of encapsulation. So he knew that. So -- and
23 he knew what he knew.

24 So by no means Karl Pichler proposed
25 thin film encapsulation knowing him because he 05:13

1 knows what he knows. I think what he was 05:13
2 concerned is what to do with the scribe lines
3 and the metal lines, and he didn't know if
4 eMagin filed or not. We didn't know. So -- and
5 I think that's what they did here. We said, 05:13
6 okay, sounds like interesting idea. Go ahead, I
7 mean I witness this, and that's how we end it.

8 What I have seen recently is that
9 actually this area of using masks for putting
10 thin film encapsulation already has been filed 05:14
11 by eMagin. I only discover that recently.

12 Q. And how did you discover that?

13 A. Just looking for prior art for thin
14 film encapsulation, to see who is who in the
15 thin film encapsulation. 05:14

16 Q. And why were you looking for who's
17 who in the thin film encapsulation?

18 MR. YANG: I caution you not to
19 reveal any communications you had with attorneys
20 or any things you're asked to do under work 05:14
21 product privilege, but if you were doing this
22 work outside of your role with litigation
23 counsel, then you can say that.

24 THE WITNESS: So I worked for about a
25 year with thin film encapsulation with Kateeva, 05:14

1 so when I was with Kateeva I looked at different 05:14
2 ways of doing this thing. Right? This is a way
3 of evaluating the technology that Kateeva was
4 pursuing. But also as a way of understanding --
5 I worked with PML when I was at HP Labs. So -- 05:15
6 and as I told you, we knew that FED Corporation
7 was not licensing or didn't want to license or
8 were not interested in the Vitex technology. So
9 we're all wondering how they're doing it, right?

10 And, of course, reviewing this 05:15
11 particular Pictiva patent, all this stuff came
12 to my mind, right? So my previous reference to
13 Motorola's patents, to the FED -- the eMagin
14 patent and PML and all like Vitex, right?

15 BY MS. ZHONG: 05:16

16 Q. So are you accusing Dr. Pichler for
17 using -- for stealing someone else's idea and
18 disclosing it?

19 A. I'm not accusing him. I'm just
20 refreshing our memory that this email, he has 05:16
21 disclosed this. I'm not disclosing it. I think
22 he's using the word "confidential" there. So...

23 Q. So you're accusing Dr. Pichler of --

24 A. No.

25 Q. -- of lifting the ideas that he -- 05:16

1 someone else had at FED and claimed to be his 05:16
2 own and filed a patent with Osram?

3 MR. YANG: Hold on a second. Object.
4 First let her finish the question. Second, give
5 me time to object. So objection. You can go 05:16
6 ahead and answer.

7 THE WITNESS: No I'm not. I don't
8 know all the background information there.
9 Okay. So I'm just reading this report, and it
10 came to my mind that he was aware of all this 05:17
11 prior art, but the motivation behind this
12 disclosure was to do something novel, something
13 new. So that's what he's focusing on, to find a
14 way to do something different.

15 BY MS. ZHONG: 05:17

16 Q. So what -- this process he described
17 that happened at eMagin was not the process he
18 is proposing in the invention disclosure; is
19 that correct?

20 A. No. 05:17

21 MR. YANG: Hold on a second.
22 Objection.

23 Go ahead.

24 THE WITNESS: I don't know. All I
25 said is that there is a patent very similar by 05:17

1 eMagin that describes something very similar. 05:17

2 Now, probably he didn't know that -- because
3 they were all filed at the same time. They were
4 filed around the time after he left from eMagin,
5 so he didn't know. So probably he didn't know 05:18
6 if eMagin had filed or not.

7 BY MS. ZHONG:

8 Q. Well, was those work done when he was
9 at eMagin?

10 A. I don't know. 05:18

11 Q. Okay.

12 A. All I know is what all of us can read
13 here.

14 Q. So you have no evidence that he --
15 someone else conceived the idea that's disclosed 05:18
16 in the invention; is that correct?

17 MR. YANG: Objection.

18 THE WITNESS: This area of protecting
19 the metals -- the area of disclosure protecting
20 the metals I believe has been claimed also by 05:18
21 eMagin for their particular application space.
22 But when Karl filed for this, he probably didn't
23 know this, so it is -- probably it's predated.
24 I don't know the exact dates here. You need to
25 look. 05:19

1 BY MS. ZHONG: 05:19

2 Q. So you have no evidence that
3 Dr. Pichler took someone else's idea and omitted
4 that person's name when he filed this invention
5 disclosure; is that correct? 05:19

6 MR. YANG: Objection.

7 THE WITNESS: Knowing Karl, he will
8 not do such a thing. He probably didn't know
9 what's filed already or not. He was doing
10 all -- everything for the best of Osram. 05:19

11 BY MS. ZHONG:

12 Q. So whether or not someone else might
13 have conceived the similar ideas, it's not the
14 case that Pichler knew someone else conceived
15 the idea and he omitted them from the invention 05:20
16 disclosure; is that correct?

17 MR. YANG: Objection. Calls for
18 speculation.

19 THE WITNESS: I don't know.

20 BY MS. ZHONG: 05:20

21 Q. So you don't know -- you are not sure
22 and you think that there's a possibility that
23 Dr. Pichler actually omitted some coinventors
24 that he knew should have been credited?

25 MR. YANG: Objection. 05:20

1 THE WITNESS: Karl is a very straight 05:20
2 guy and very honest, that's why he discloses all
3 this here, right. So he will not lie or -- I
4 mean, you can see it's obvious from his writing,
5 all the background information that he is 05:21
6 carrying along.

7 Osram was working on soluble OLEDs
8 where eMagin was working on vacuum-deposited
9 OLEDs. Processes are different. So I can only
10 speculate here because I don't know. 05:21

11 BY MS. ZHONG:

12 Q. So you know that Dr. Pichler is a
13 straight shooter, correct?

14 A. Yes.

15 Q. He's very honest. Dr. Pichler is an 05:21
16 honest person?

17 MR. YANG: Objection.

18 THE WITNESS: Through my personal
19 interactions, yes.

20 BY MS. ZHONG: 05:21

21 Q. And you did not believe that he would
22 have intentionally left off a coinventor,
23 correct?

24 MR. YANG: Objection.

25 THE WITNESS: I don't think so. What 05:21

1 we see here in the very first page that may or 05:22
2 may not be related to this patent is all the
3 information that is floating around those days,
4 right? Some of this -- I don't know exactly
5 what happened after this documentation was 05:22
6 collected. It's conceivable that at the time
7 we're not aware of any competing ideas.

8 BY MS. ZHONG:

9 Q. Okay.

10 A. So we decided to proceed with the 05:22
11 filing, but after that I don't know. Right.

12 Q. Okay. Can you please take a look at
13 item number 7?

14 A. This is from the list, back at the
15 list. 05:22

16 Q. Page 14, item number 7.

17 And do you see that Dr. Pichler
18 stated that the invention has not been tested
19 yet and he said:

20 "Internally I am certain and outside 05:23
21 our company - I am not aware of anybody
22 who tried it and/or any prior art."

23 Do you see that?

24 A. Yes.

25 Q. And based on what you know of 05:23

1 Dr. Pichler, do you believe that he wrote this 05:23
2 statement accurately and truthfully?

3 MR. YANG: Objection.

4 THE WITNESS: I mean, I don't know
5 this. I would infer that he did, but there is a 05:23
6 period of -- maybe there were coinventions from
7 other companies. He wouldn't know this because
8 they were all applications. Right. So he says
9 the truth, according to his reference, that
10 there may be an application pending on the other 05:24
11 side. All we see here is that there is actually
12 an application happening in parallel.

13 BY MS. ZHONG:

14 Q. So as far as you know, you don't
15 believe that he intentionally left off a 05:24
16 coinventor for somewhere else?

17 MR. YANG: Objection.

18 THE WITNESS: You're asking me
19 something personal. I don't know. This is a
20 question to ask the legal team of Osram because 05:24
21 I was not a -- a participant in the filing
22 process. I was just a witness.

23 BY MS. ZHONG:

24 Q. How would you know of Dr. Pichler as
25 a person? Do you think that he stated 05:24

1 truthfully when he said: 05:25

2 "I am not aware of anybody who tried
3 it and/or any prior art"?

4 A. So the date that he disclosed that,
5 probably that's true. 05:25

6 Q. Okay. And in the eMagin patent that
7 you say you have recently recovered, did they
8 disclose using inkjet printing of UV-curable
9 liquid prior to the dielectric deposition?

10 A. I don't remember. I don't know if 05:25
11 they disclosed that.

12 Q. And do you see that Dr. Pichler
13 stated that he "did some prior art searching to
14 check UV curable liquid inkjet printing"?

15 A. Yes. So as a reference, the idea of 05:25
16 a UV curable material for thin film
17 encapsulation was proposed by Battelle and
18 Vitex. So that's input number one.

19 The digital or additive printing
20 using inkjet printing is another technology that 05:26
21 is also used for different applications. The
22 argument here is that when you bring those two
23 things together, are they obvious or are they
24 novel? That to be discussed, right? But the UV
25 curable PML was doing that all the time. This 05:26

1 is not new. 05:26

2 Q. Well, were you aware of an inkjet
3 printing of the UV curable organic liquid?

4 A. I don't know if inkjet printing was
5 used at that time or UV curable materials. I 05:26
6 don't know that.

7 Q. And you don't have any opinion on
8 whether this was obvious or novel to do that,
9 correct?

10 A. Well, it's difficult to tell now 05:27
11 because I have 25 years of experience in my
12 head.

13 Q. That's the whole problem. You had
14 too much post-knowledge.

15 A. So the -- those days there was -- 05:27
16 everything was in the making, right? And one
17 thing to keep in mind, again, to emphasize this,
18 that Osram did not reduce this technology to
19 practice. Maybe later they did, but I don't --

20 I know that for a fact we did not have a thin 05:27
21 film encapsulation tool in San Jose. We would
22 evaluate to see what else is happening in the
23 industry, but we couldn't buy a tool. The tools
24 were not commercially available or whatever was
25 available was not working. 05:27

1 Q. Was it a requirement for the patent 05:27
2 to reduce the invention to actual practice
3 before you file a patent?

4 MR. YANG: Objection.

5 THE WITNESS: I don't think it's a 05:28
6 requirement.

7 BY MS. ZHONG:

8 Q. And is Dr. Pichler a creative person?

9 MR. YANG: Objection.

10 THE WITNESS: I mean, why this thing 05:28
11 is related to this. He's a great scientist.

12 BY MS. ZHONG:

13 Q. So he has above -- at least
14 above-average skill set?

15 A. It's difficult to ask me these 05:28
16 questions. I'm not here to judge Karl. He's
17 also a very close friend, so I --

18 Q. Do you believe that he has
19 above-average creativity and skill set?

20 A. He's a very good scientist, a very 05:28
21 good engineer.

22 Q. Above average, at least?

23 A. It's for someone else to judge.

24 Q. Do you describe someone -- an average
25 person as a good scientist? 05:29

1 A. How is this related to what we're 05:29
2 doing here? What are you trying to get at?

3 Q. It doesn't matter. You need to
4 answer the question truthfully.

5 A. I'm answering truthfully. He's a 05:29
6 very good guy, and, you know, I've maintained a
7 close relationship with him over the years.

8 Q. Are you aware that Samsung is
9 accusing of him of leaving off other people --

10 MR. YANG: Objection. 05:29

11 BY MS. ZHONG:

12 Q. -- leaving other inventors off the
13 patent?

14 MR. YANG: Objection.

15 THE WITNESS: I'm not aware of this. 05:29

16 BY MS. ZHONG:

17 Q. Are you aware that Samsung claims
18 that eMagin actually invented this whole
19 invention and not Dr. Pichler?

20 A. I'm not aware of this. I'm only 05:30
21 aware of the prior art.

22 Q. Okay. Do you have any doubt that
23 Dr. Pichler came up with what he disclosed in
24 this invention disclosure?

25 A. Sorry, I didn't hear. Can you 05:30

1 repeat, please? 05:30

2 Q. Do you have any doubt that
3 Dr. Pichler came up with what he disclosed in
4 this invention disclosure?

5 MR. YANG: Objection. 05:30

6 THE WITNESS: I can only speculate.
7 He filed this disclosure without knowing what
8 exactly the prior art was, but I can only say
9 that. He even disclosed that to us.

10 BY MS. ZHONG: 05:31

11 Q. Did he, himself, come up with the
12 idea disclosed in this invention disclosure
13 regardless of whether someone else independently
14 came up with the idea?

15 MR. YANG: Objection. 05:31

16 THE WITNESS: He -- he disclosed what
17 he disclosed thinking that potentially this
18 thing would be patentable. Genuinely thinking
19 that, but, yeah, that's all we can say.

20 BY MS. ZHONG: 05:31

21 Q. Okay. And you don't believe that he
22 took someone else's idea and sold it as his own
23 idea, correct?

24 A. Well, I don't know all the -- what is
25 claimed. I don't remember very well what the 05:32

1 patents are claiming. The inkjet printing as a 05:32
2 process is not way new. The way of using
3 stencils to protect the metals is not new. The
4 combination for soluble OLEDs may be new.

5 So usually when you file these 05:32
6 ideas -- now, to me, it looks like an obvious
7 thing with all this prior art, but those days
8 probably he believed that this is patentable
9 without even violating any confidentiality or
10 anything like that. 05:32

11 Q. So 25 years later, looking back, he
12 said, oh, that's pretty obvious?

13 A. No, it's matter of dates, who filed
14 what when. That's the strength, first to file,
15 right. I don't exactly know when the first to 05:33
16 file rule was implemented, but it's all about
17 dates.

18 Q. At the time was it obvious to you to
19 use inkjet printing to deposit the organic
20 layers for the TFE? 05:33

21 A. So those days, what was obvious --
22 even in the 90s, what was obvious was to use
23 inkjet printing for patterning OLEDs. Well, I
24 should say -- obvious. We were all trying to
25 find a way to pattern OLEDs with inkjet 05:33

1 printing. And there are many companies 05:33
2 submitted filings like that. This was all prior
3 art, right? So...

4 Q. When you talk about that, that's
5 talking about the pixels not the encapsulation, 05:33
6 right?

7 A. Correct, pixels, yes.

8 Q. Were you aware of any prior art using
9 inkjet printing for encapsulation layers?

10 MR. YANG: Objection. 05:34

11 THE WITNESS: I don't remember for
12 those days. I know for a fact that when we used
13 to introduce printing areas or annotative areas,
14 we will list everything, laser printing, screen
15 printing, stencil, et cetera. 05:34

16 BY MS. ZHONG:

17 Q. And that's with Dr. Kyle Pichler who
18 had many years experience in that area --

19 MR. YANG: Objection.

20 BY MS. ZHONG: 05:34

21 Q. -- proposing the ideas, correct?

22 A. I don't know. I don't know. And I
23 don't remember. But every time we would propose
24 something that had to do with printing on demand
25 in areas that you care to print, you propose 05:34

1 more than one printing technique just to cover 05:34
2 your bases.

3 Q. On your team, how many researchers
4 are people with bachelor's degree and only one
5 year of experience in displays? 05:35

6 A. You mean those days at Osram?

7 Q. Mm-hmm.

8 A. I don't remember very well, but we
9 will try to hire people with prior experience on
10 displays, either through the BSD program or 05:35
11 through previous experience.

12 Q. So is it fair to say that it was
13 pretty rare back in those days at Osram for you
14 to have someone with only one year of experience
15 in displays and only a Ph -- only a bachelor's 05:35
16 degree?

17 MR. YANG: Objection.

18 THE WITNESS: We had a lot of interns
19 at Osram during the summers, and these guys were
20 all undergraduates or master students. 05:36

21 BY MS. ZHONG:

22 Q. Were they named on any of the
23 patents?

24 A. I have joined patents with some of
25 them. Like Benjamin Krummacher was a -- I don't 05:36

1 remember he was a master student or 05:36
2 undergraduate, but these are all high-quality
3 people. So I don't think it's good to
4 generalize what you just said.

5 Q. And what area did Mr. or 05:36
6 Dr. Krummacher work on?

7 A. He worked on many different areas.
8 We overlapped in the area of using the phosphors
9 as a way of generating white light in combining
10 blue and light and phosphors. That was a 05:36
11 concept that was pursued by a few more people,
12 not only us. GE had a program like this too.

13 Q. Okay. And instead of phosphors, were
14 quantum dots being used?

15 A. We didn't pursue that because the 05:37
16 quantum dots were not available. But people
17 were talking about quantum dots around that
18 time.

19 Q. Now, you had stated that there is an
20 eMagin patent that you claim to have disclosed 05:38
21 some of the same ideas as Dr. Pichler.

22 A. I don't remember the numbers on top
23 of my head. I remember seeing a couple of these
24 applications and a lot of patents.

25 Q. And did you discuss any in your 05:38

1 report at all? 05:38

2 A. No, I have not.

3 Q. Okay. Did you compare the disclosure

4 of those patents to the claims of the '389

5 Patent that issued from the invention 05:39

6 disclosure?

7 A. I have looked at the Pictiva patents,

8 the '389 claims, and I also have looked at the

9 eMagin, and I have -- what trigger to my mind is

10 a, I would say, similarity of some sort. 05:39

11 Q. Did you do an element-by-element

12 analysis?

13 A. No. I have haven't done this.

14 Q. Okay. And you --

15 A. I spoke with -- 05:39

16 Q. Go ahead.

17 A. I saw a graph here on this

18 disclosure. Well, you know some of those things

19 are obvious to separate them like this, but I

20 don't know what page. On page 38, that looks 05:39

21 similar to what I've seen in the eMagin. Of

22 course, in 2001, no one knew this.

23 Q. You did not do an element-by-element

24 analysis?

25 A. I don't know what element -- you're 05:40

1 saying claim -- no, I have not done -- I don't 05:40
2 know what element by element is.

3 Q. Okay. And you were only talking
4 about high-level similarity of the disclosure,
5 correct? 05:40

6 A. Yes.

7 Q. Okay. And you are not offering an
8 opinion here that Dr. Pichler's patents are
9 invalid, correct?

10 A. No, I'm not. 05:40

11 Q. And you are not stating that
12 Dr. Pichler left off some other inventors from
13 eMagin, correct?

14 A. I'm not claiming that whatsoever.

15 Q. Now, you mentioned that when you were 05:40
16 at Osram, the legal department encouraged the
17 engineers to file invention disclosures; is that
18 correct?

19 A. Yes. This is true for all companies
20 that I worked. 05:41

21 Q. Why is it important for the engineers
22 to file invention disclosures?

23 MR. YANG: Objection.

24 THE WITNESS: It depends on the
25 circumstances. In the case of Osram, we were 05:41

1 new to the field and -- as a business, so we 05:41
2 wanted to enrich our IP portfolio. The same
3 thing happened in my startup. We will
4 incentivize the engineers to propose inventions
5 that we will move forward for patent 05:41
6 applications. I mean, in some cases, having
7 strong IP is important.

8 BY MS. ZHONG:

9 Q. Why is it important to have strong
10 IPs? 05:41

11 MR. YANG: Objection.

12 THE WITNESS: In some cases, not
13 always. It depends. Right? For a startup,
14 early-stage startup, it would be important.
15 That's how you raise money. 05:42

16 BY MS. ZHONG:

17 Q. Why was it important for Osram to
18 file patent applications?

19 MR. YANG: Objection.

20 THE WITNESS: Based on my knowledge 05:42
21 without knowing the bigger picture, we didn't
22 have a lot of IP on our own.

23 BY MS. ZHONG:

24 Q. Why was it important for Osram to
25 have IPs of their own? 05:42

1 MR. YANG: Objection. 05:42

2 THE WITNESS: I don't know really.

3 One of the reasons perhaps is to secure -- to

4 have the freedom to manufacture. We licensed

5 patents. We licensed IP from CDT and 05:42

6 DuPont/UNIX, so we wanted to build around this

7 and have the freedom to operate in the soluble

8 OLEDs.

9 BY MS. ZHONG:

10 Q. So Osram licenses the necessary 05:42

11 patents -- strike that.

12 So Osram will license others patents

13 when it was necessary; is that correct?

14 MR. YANG: Objection.

15 THE WITNESS: I don't remember. This 05:43

16 is prior to my time there. I start in 2000, but

17 I'm aware, this is public information, that

18 Osram licensed the soluble OLED patents from

19 Cambridge Display Technology as well as from

20 UNIX/DuPont. 05:43

21 BY MS. ZHONG:

22 Q. So Osram did not just pick someone

23 else's intellectual property and use it without

24 compensation, correct?

25 A. I'm not aware of this. They were 05:43

1 very transparent with licensing technology. 05:43
2 They required technology but Osram worked
3 diligently in developing technologies. Like the
4 glass-glass encapsulation was pioneered. So we
5 were the first ones to do that. The coating of 05:44
6 the materials, the different colors, the
7 monochrome displays, the metalization. There
8 are many things that we did that were very
9 unique and we were the first to do it.

10 Q. So Osram respected third-party 05:44
11 intellectual properties and it would license
12 them if it did not have the technology already;
13 is that correct?

14 MR. YANG: Objection.

15 THE WITNESS: I can only speak about 05:44
16 what we did with the very first licensing
17 agreements. I don't know what happened later.

18 BY MS. ZHONG:

19 Q. When you say I can only speak about
20 what we did in the very first licensing 05:44
21 agreement --

22 A. Well, I can only speak about the
23 initial years of the soluble OLED passive matrix
24 manufacturing to make sure that we had a free
25 path to manufacture for the products of 05:45

1 interest. 05:45

2 Q. Do you think that --

3 THE COURT REPORTER: One second,
4 please.

5 MS. ZHONG: Sure. 05:45

6 (Brief pause in proceedings.)

7 BY MS. ZHONG:

8 Q. Do you think that it was -- if a
9 manufacturer is using a third-party intellectual
10 property, do you think that it's important for 05:46
11 that manufacturer to obtain the necessary
12 license in order to use a technology?

13 MR. YANG: Objection.

14 THE WITNESS: I guess it depends on
15 the development stage and at the time you 05:46
16 introducing the product. If you introduce a
17 product in the market, you will have to have the
18 permission, the freedom to operate manufacturing
19 and selling the product.

20 BY MS. ZHONG: 05:46

21 Q. So you think that if someone starts
22 to sell a commercial product, they should obtain
23 the license to the appropriate intellectual
24 property; is that correct?

25 MR. YANG: Objection. 05:46

1 THE WITNESS: You're asking me for my 05:46
2 personal experience in general?

3 BY MS. ZHONG:

4 Q. Yes.

5 A. When I was with DuPont and when we 05:47
6 developed the photovoltaics business, we didn't
7 have any major licensing going on. We did some
8 licensing in the beginning as a way of showing
9 to the world that we are covered in making this
10 particular technology, but we end up not using 05:47
11 it and we returned the IP. So I have mixed
12 feelings about this, how important it is.

13 Q. So you think it's okay for someone
14 just to use a technology without compensating
15 the IP owner? 05:47

16 A. Well, it depends on the case, right?
17 I mean, if there is a true violation of the IP
18 rights, of course that needs to be looked at.
19 But you need to look -- demonstrate this, that
20 there is a violation. 05:47

21 Q. So if someone goes to a patent owner
22 to say I'm interested in buying this particular
23 patent, and then when the purchase did not go
24 through, is it okay for that manufacturer to use
25 the particular -- the patented technology 05:48

1 without paying the patent owner for any 05:48
2 compensation?

3 MR. YANG: Objection. Incomplete
4 hypothetical.

5 THE WITNESS: I don't -- I don't 05:48
6 know. I mean, it's -- I agree with Lance, one
7 question after -- I mean, one hypothesis after
8 the other. Maybe if you want to ask a more
9 specific question.

10 BY MS. ZHONG: 05:49

11 Q. So if Samsung is using Osram's
12 patents, should Samsung be paying for the
13 privilege of using the technology?

14 MR. YANG: Objection.

15 THE WITNESS: It's not for me to 05:49
16 judge this, right? I cannot answer this.

17 BY MS. ZHONG:

18 Q. So you think it's okay for Samsung to
19 not compensate Osram for using their patented
20 technology? 05:49

21 A. Through my studies I've seen that
22 Samsung is notorious for licensing or acquiring
23 patents throughout their 20 years of report.
24 I've seen this thing. They don't shy to go and
25 acquire the technology when they realize that 05:49

1 it's valid to enable the manufacturing. I mean, 05:49
2 they have done a lot of acquisitions from the
3 OLEDs. I mean, the facts speak by themselves.
4 They have done 10 acquisitions from OLEDs.

5 Q. They've also been forced to -- 05:50
6 they've also been taken to court and forced to
7 take a license after they lost its lawsuit,
8 correct?

9 MR. YANG: Objection.

10 THE WITNESS: I don't know all these 05:50
11 details. I know that they acquired a lot of
12 interesting technologies. This is not only one
13 or two, it's multiple.

14 BY MS. ZHONG:

15 Q. So you think it's important for a 05:50
16 company like Samsung to properly compensate the
17 patent owner for the usage of the intellectual
18 property; is that correct?

19 A. I believe it's important to clear the
20 path for manufacturing by owning or licensing 05:50
21 all the IP that is required to manufacture
22 certain part and they have done so over the
23 years.

24 Q. You know that Samsung has been found
25 to infringe many patents over the years, 05:51

1 correct? 05:51
2 A. I don't know.
3 MR. YANG: Objection.
4 BY MS. ZHONG:
5 Q. Have you done any analysis to see 05:51
6 whether Samsung has got all the correct -- all
7 the necessary licenses or IP ownership for
8 their -- for their products?
9 A. I have not done this thorough
10 analysis. I only know throughout my experience 05:51
11 the -- some of the companies they have acquired,
12 like Vitex, like Novaled and the like. eMagin
13 recently.
14 Q. Is Kateeva -- does Kateeva have
15 any -- strike that. 05:52
16 Is Samsung an investor in Kateeva?
17 A. I don't remember. I don't remember.
18 They may have been one of the original
19 investors. I don't remember.
20 Q. Is -- does Samsung have any 05:52
21 investment or collaboration relationship with
22 Nanosys?
23 A. It's public that Samsung has a
24 license or held the license agreement for
25 Nanosys on quantum dots. It's a very long-term 05:52

05:53

05:53

05:53

05:54

1

2

3

4

5

6

7

8

BY MS. ZHONG:

9

10

Q. And did Nanosys develop cadmium-free quantum dots?

05:55

11

12

13

A. Yes. They are the leader in this area, the so-called indium phosphide. They have the key IP in this area.

14

15

Q. How does Samsung's OLED technology compare to its competitors?

05:56

16

MR. YANG: Objection.

17

18

19

THE WITNESS: In what -- it depends, right? Can you specify what do you mean by the question? Can we take a more specific example?

20

BY MS. ZHONG:

05:56

21

22

Q. You can give an overview and you can go to the more specifics.

23

MR. YANG: Objection.

24

25

THE WITNESS: What do you mean? It would be easier if you ask a particular

05:57

1 question. Then I can answer it. 05:57

2 BY MS. ZHONG:

3 Q. How does Samsung's OLED technology
4 compare to BOEs?

5 MR. YANG: Objection. 05:57

6 THE WITNESS: Very general question.

7 I can only comment that Samsung started OLEDs
8 before 2000. And BOE started OLEDs recently. I
9 don't know exactly the year. So Samsung has a
10 lot more experience making OLEDs versus others. 05:57

11 I can make that statement. We can go to more
12 specifics if you like. I have monitored the
13 progress over the last 20 years, 25 years.

14 BY MS. ZHONG:

15 Q. Samsung -- when Samsung first started 05:58
16 it licensed the Kodak's basic technology,
17 correct?

18 A. If I recall, yes, and also the UDC,
19 Universal Display Corporation, for the use of
20 the metal chelates for light emission. 05:58

21 Q. So Samsung licensed from UDC the use
22 of phosphorescent --

23 A. Yes.

24 Q. -- correct?

25 A. Yes. But I don't know the specifics. 05:58

1 Q. And by "UDC," you mean Universal 05:58
2 Display Corporation, correct?

3 A. Yes.

4 Q. How does the quality of Samsung's
5 OLED display panel compared to that of BOEs? 05:58

6 MR. YANG: Objection.

7 THE WITNESS: Well, in terms of what?

8 BY MS. ZHONG:

9 Q. What are some of the important
10 parameters for an enterprise with an OLED 05:59
11 device? What are some of the important
12 parameters to a consumer?

13 MR. YANG: Objection.

14 THE WITNESS: I can only make the
15 comment that a few years ago, Samsung had 05:59
16 100 percent of the market capacity of OLEDs
17 sharing it with LG and couple of others, but
18 they had the lion's share in the production of
19 high-definition OLED displays from about 2000.

20 BY MS. ZHONG: 05:59

21 Q. And since then BOE has -- strike
22 that.

23 Since then Samsung's market share has
24 decreased and BOE's market share has increased
25 significantly, correct? 05:59

1 A. Well, there's a lot of competition in 06:00
2 the market but Samsung still has the larger
3 percentage in mass production. But there is --
4 a lot of people basically are -- envy their
5 successful business in OLEDs. 06:00

6 Q. In fact, BOE is making gains on
7 Samsung's OLED display technology even in
8 high-end products such as Apple's iPhones,
9 correct?

10 A. I don't know the exact numbers, but I 06:00
11 hear this from conferences and the like, and
12 what I'm reading. But I don't know what
13 percentages. This is very recent thing.

14 Q. And in more than -- in today's mobile
15 phones, tablets and watches, are the green and 06:01
16 red pixels in those commercial products tend to
17 be phosphorescent emitters with a metal complex?

18 MR. YANG: Objection.

19 THE WITNESS: I don't know
20 100 percent. Don't know the exact answer, but a 06:01
21 good portion of those are phosphorescent. The
22 red was first and then the green, but I don't
23 know everything is with these compounds. There
24 is, again, competition in that space.

25 / / /

1 BY MS. ZHONG: 06:02

2 Q. Do you know whether lithium quinolate
3 was used as a common component in the electron
4 transport layers?

5 A. I don't know. You're referring to 06:02
6 Samsung or to in general?

7 Q. In general.

8 A. So let me repeat your question. Are
9 you asking if the lithium --

10 Q. So is -- so is lithium quinolate 06:02
11 used -- strike that.

12 So is lithium quinolate commonly used
13 with another organic material as part of the
14 electron transport layer?

15 A. Commonly -- 06:02

16 MR. YANG: Objection.

17 THE WITNESS: I don't know how
18 commonly it's used. I have seen publications
19 but I don't know if it's used in manufacturing
20 today. That I don't know. 06:03

21 BY MS. ZHONG:

22 Q. So you don't really know the material
23 sets that's used in Samsung's display panels,
24 correct?

25 A. I don't. Yeah. This information has 06:03

1 not been communicated to me. 06:03

2 Q. Isn't it important for companies to
3 respect third parties -- strike that.

4 Is it important for a company to
5 respect other company's intellectual 06:03
6 properties?

7 MR. YANG: Objection.

8 THE WITNESS: It depends on the case,
9 right? Case by case.

10 BY MS. ZHONG: 06:04

11 Q. Under what circumstances it is not
12 important for a company to respect another
13 company's intellectual property?

14 MR. YANG: Objection.

15 THE WITNESS: I mean, it's very 06:04
16 complex, the question and perhaps answer. If
17 you're violating someone's -- blindly someone's
18 intellectual property and you don't have rights
19 to this, you should be looking into licensing
20 this. But violating or not it's a very 06:04
21 difficult answer to explore. It's not that
22 easy.

23 BY MS. ZHONG:

24 Q. So if a company is violating a third
25 party's intellectual property -- property and it 06:04

1 does not have rights to that intellectual 06:04
2 property, that company, in your opinion, should
3 be looking into licensing the intellectual
4 property; is that correct?

5 MR. YANG: Objection. 06:05

6 THE WITNESS: Can I answer this thing
7 with an example? The use of iridium compounds
8 for light emission, it's undisputedly owned by
9 UDC, to my knowledge. And that's why UDC has
10 been so successful in licensing the technology. 06:05
11 You can reverse engineer every device that is
12 made out there. And if these phosphorescent
13 compounds are used, are you violating the IP?
14 That's why UDC is licensing this IP to
15 everybody. So in this case you have to respect 06:05
16 IP.

17 BY MS. ZHONG:

18 Q. I understand that you are not
19 offering an opinion of infringement or
20 non-infringement in this case, correct? 06:06

21 A. Yes. I'm not.

22 Q. So if Samsung is violating Osram's
23 intellectual property, should Samsung be
24 licensing the technology?

25 MR. YANG: Objection. 06:06

1 THE WITNESS: I'm not here to answer 06:06
 2 this particular one, right? I mean, if you want
 3 my personal opinion, if there is a clear
 4 evidence of, perhaps, violation, then it should
 5 be explored further. But personally, after 06:06
 6 looking at all these files from Pictiva, I
 7 didn't see any obvious and blind violation.

8 BY MS. ZHONG:

9 Q. You don't know what materials are
 10 used by Samsung, correct? 06:07

11 A. Again, yes. There are a couple of
 12 patents that are Pictiva that I cannot comment
 13 because they were filed later. So forgive me, I
 14 cannot say anything there.

15 Q. Okay. [REDACTED] [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED] 06:07

21 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED] 06:08

1

█

█

█

█

█

7

Q. You are not offering any opinion --

8

A. You're asking me so I'm answering.

9

Personal opinion. Not official.

10

Q. You are not offering any opinion on 06:08

11

validity, correct?

12

A. I'm not.

13

Q. In fact, you have not really compared

14

what you call the eMagin patents with the

15

claims? 06:08

16

A. No. I have not done a detailed

17

analysis.

18

Q. █ █?
█
█
█

22

MR. YANG: Objection.

23

THE WITNESS: I don't know. There

24

are inorganic depositions and then there are

25

organic depositions. I don't know the details. 06:09

1 BY MS. ZHONG: 06:09

2 Q. So you have no idea what Samsung is
3 doing in their manufacturing process?

4 A. I know they do thin film
5 encapsulation. 06:09

6 Q. Do you know how they do the thin film
7 encapsulation?

8 A. The details, no, I do not.

9 [REDACTED]
[REDACTED] [REDACTED]
[REDACTED] [REDACTED]
[REDACTED] [REDACTED].

13 Q. Do you know whether they're -- do you
14 know how they are depositing the inorganic
15 materials? 06:10

16 A. I don't know the details. [REDACTED]
[REDACTED]
[REDACTED]. I don't know the details.

19 Q. Do you know how they apply them?

20 A. All I know is that there are [REDACTED] [REDACTED]
[REDACTED] used.

22 Q. Do you know whether [REDACTED]
[REDACTED]
[REDACTED]?

25 A. Yes. 06:10

1 MR. YANG: Objection. 06:10

2 THE WITNESS: I don't know. And I
3 don't think this was disclosed in the report. I
4 don't remember seeing this.

5 BY MS. ZHONG: 06:10

6 Q. Okay. So you have no basis to
7 conclude one way or the other whether Samsung's
8 using the '389 patent or not, correct?

9 A. I'm only commenting on this based on
10 the fact that my personal assessment of the 06:11
11 '389, it's based on prior art. That's why I'm
12 saying that.

13 Q. But you have not compared the prior
14 art to the claims --

15 A. I have not. 06:11

16 Q. -- by doing a claim-by-claim
17 element -- element analysis? So basically you
18 did not do an element-by-element analysis of the
19 prior art?

20 A. Yeah, I said I didn't do it. 06:11

21 Q. Okay. So you have no basis to
22 conclude that those were actually prior art or
23 invalidate the '389 Patent, correct?

24 A. Yes. I -- based on the fact that
25 thin film encapsulation was used by -- the 06:12

1 concept of alternating organic and inorganic 06:12
2 layer and how you put it down to achieve certain
3 things has been done before.

4 What we discussed, an important
5 factor there, is [REDACTED] [REDACTED]

6 [REDACTED]

7 [REDACTED]

8 [REDACTED]

9 [REDACTED]

10 [REDACTED] [REDACTED]

11 [REDACTED] How exactly

12 they do it has not been disclosed to me.

13 Q. And do you think that it would have
14 been -- strike that.

15 Do you think there would be 06:12
16 manufacturability if the organic layers and the
17 inorganic layers were deposited in a planar
18 fashion?

19 A. I cannot comment on that for a fact
20 because I don't know exactly how they -- what 06:13
21 they did and how they improved it.

22 So I cannot say that to do a
23 quantitative analysis, one versus the other.

24 Q. Even qualitatively, do you think that
25 it would have been a commercially viable process 06:13

1 for them to blanketly deposit the organic and 06:13
2 inorganic layer from independent --

3 A. I don't know. I don't know. All I
4 know is the multilayer process that was proposed
5 by previous art has been reduced to fewer 06:13
6 layers. That's what I know for a fact. There
7 are publications of some of these lines. How
8 they Vitex/PML technology evolved to be easier
9 to make and manufacturable.

10 Q. But you have not made a determination 06:14
11 as to whether it would have been a commercially
12 viable process if the deposition had been
13 non-targeted and covering up all the metal pads
14 and the scribe lines; is that correct?

15 MR. YANG: Objection. 06:14

16 THE WITNESS: I haven't done this
17 particular analysis. I mean, you have to look
18 at data on both sides to opine on this, and I
19 haven't seen the data.

20 BY MS. ZHONG: 06:14

21 Q. And you have not seen the inkjet
22 printing in the OLED -- strike that.

23 You have not seen using inkjet to
24 print the organic layer of the thin film
25 encapsulation in the eMagin patents you 06:15

1 mentioned, correct? 06:15

2 MR. YANG: Hold on. Objection. Just
3 wait for her to finish the question.

4 (Reporter clarification.)

5 THE WITNESS: Can you repeat, please, 06:15
6 the question.

7

8 BY MS. ZHONG:

9 Q. It's a company named eMagin.

10 The eMagin patents you mentioned did 06:15
11 not disclose the use of inkjet printing to
12 apply the organic layer; is that correct?

13 MR. YANG: Objection.

14 THE WITNESS: I don't remember very
15 well, but I remember that they did some kind of 06:16
16 an organic layer with using masks or other
17 techniques. I don't remember what they claimed
18 exactly.

19 BY MS. ZHONG:

20 Q. No inkjet printing technology as far 06:16
21 as you recall, correct?

22 A. I don't remember.

23 MR. YANG: Objection.

24 BY MS. ZHONG:

25 Q. You don't recall reference to any 06:16

1 inorganic deposition. Applied Materials is 06:18
2 doing inorganic deposition. They also have done
3 the organic deposition without using inkjet
4 printing. I don't know what they're doing
5 today. And there are some chemical companies 06:18
6 that they sell the organic stuff but I don't
7 know how they put them down.

8 Q. Are those for OLEDs?

9 A. OLEDs, OLEDs, yes.

10 Q. Applied Materials is making display 06:18
11 materials?

12 A. Applied Materials is one of the major
13 suppliers for thin film transistors, and they
14 are a major supplier for the inorganic field.

15 Q. Is applied materials a major supplier 06:18
16 for the materials used in the thin film
17 encapsulations for the OLEDs?

18 A. They have a strong position, I
19 believe, on the nitride deposition.

20 Q. But not for the organic layers? 06:19

21 A. In the past, I think they had a tool
22 in this area.

23 Q. But they are no longer a major
24 supplier for the tool for the organic layer
25 deposition; is that correct? 06:19

1 MR. YANG: Objection. 06:19

2 THE WITNESS: I don't know -- I don't
3 know what capacity they have. I have heard
4 presentations, I've heard them talking about
5 this, but I don't know their engagement in the 06:19
6 marketplace.

7 BY MS. ZHONG:

8 Q. So for the major OLED display panel
9 suppliers, do you know how they are performing
10 the thin film encapsulation, especially for the 06:20
11 organic layers?

12 MR. YANG: Objection.

13 THE WITNESS: I don't have
14 information from all the major suppliers. When
15 I was with Kateeva I know we were very busy 06:20
16 selling these inkjet printers for depositing the
17 organic layer.

18 BY MS. ZHONG:

19 Q. And do you know which companies
20 adopted that technology? 06:20

21 MR. YANG: Objection.

22 THE WITNESS: I don't know all the
23 details.

24 BY MS. ZHONG:

25 Q. When you reviewed the Pictiva 06:20

1 patents, you reviewed primarily the examples 06:22
2 disclosed in those patents, correct?

3 MR. YANG: Objection.

4 THE WITNESS: I read the patents and
5 I -- just for me to better understand what they 06:22
6 were describing in there and trying to see if
7 some of these ideas there have been disclosed
8 before.

9 BY MS. ZHONG:

10 Q. Were you examining the claims or were 06:22
11 you examining the examples?

12 MR. YANG: Objection.

13 THE WITNESS: I would read in general
14 the topic and the field of use just for me to
15 get familiar with the technology behind it. I 06:22
16 read the whole thing.

17 BY MS. ZHONG:

18 Q. Did you examine Samsung's accused
19 products?

20 A. I don't know all the details there. 06:23
21 I'm not very familiar with this question.

22 Q. Okay.

23 A. I didn't know specifically which
24 products have been silenced. I don't know that.
25 I saw Samsung as a whole. 06:23

1 Q. Do you know which products are at 06:23
2 issue in this case?

3 A. No. I thought all of them, but I'm
4 not sure.

5 Q. Okay. It was known in 2006 and 2007 06:23
6 to Dr. Krummacher that the color conversion
7 layer can be a quantum dot layer, correct?

8 MR. YANG: Objection.

9 THE WITNESS: If I recall from this
10 morning, you showed me a paragraph where we list 06:24
11 all classes of light emitters. Not specifically
12 quantum dots. We basically took a swath of
13 everything.

14 BY MS. ZHONG:

15 Q. So that was a knowledge that 06:24
16 Dr. Krummacher had, correct?

17 MR. YANG: Objection.

18 BY MS. ZHONG:

19 Q. So the use of quantum dot as a color
20 conversion layer, that was knowledge that 06:25
21 Dr. Krummacher had in 2006 and 2007, correct?

22 MR. YANG: Objection.

23 THE WITNESS: We wrote this patent --
24 this patent was executed in terms of the
25 writing, the details a little bit later after I 06:25

1 left. We were proposing at the beginning 06:25
2 phosphors. So I don't know the details of the
3 filings. There are many continuations of this
4 patent that continued after I left. But most of
5 them, they're evolving around phosphors. 06:25

6 BY MS. ZHONG:

7 Q. The quantum dots was mentioned?

8 A. As you shared with me in the
9 description, it was mentioned, yeah. But also
10 organic materials were mentioned and other -- 06:25
11 everything in the literature that absorbs lights
12 and emits light was mentioned as a way of
13 including everything.

14 Q. And did you know whether eMagin
15 actually carried out their -- the use of a mask 06:26
16 in depositing thin film encapsulations?

17 A. I don't know how imagine does thin
18 film encapsulation, but in their thin film
19 encapsulation patents, they described structures
20 where the metallic lines are not coated by thin 06:26
21 film encapsulation. I don't remember very well,
22 but I think they are -- I don't remember. I
23 need to review this. I think they are proposing
24 some kind of a masking scheme. There's no other
25 way of doing the organic layer. This is 06:27

1 standard part. 06:27

2 MR. YANG: Annita, I think we're just
3 coming up on seven hours so I'll be ending
4 the -- approaching the end of the deposition
5 time. 06:27

6 MS. ZHONG: Okay. Understood. Even
7 though he was supposed to be offered as both --
8 separately as a fact witness and expert witness,
9 you understand that, right?

10 MR. YANG: Fair enough. I understand 06:27
11 your position. I'm just pointing out that
12 seven hours is approaching.

13 MS. ZHONG: I understand that.

14 THE WITNESS: I think I got a good
15 dose of fact questions today. I don't know. 06:28
16 I'm not an expert.

17 MR. YANG: Homer, you're not being
18 asked questions.

19 BY MS. ZHONG:

20 Q. Do you consider yourself to be an 06:28
21 expert?

22 A. Expert in OLEDs, yes.

23 Q. Okay. In which area of OLEDs do you
24 consider yourself to be an expert?

25 A. Mostly in the fabrication of the OLED 06:28

1 technology, more so than the electronics, more 06:28
2 so than the firmware downstream.

3 Q. You don't consider yourself to be an
4 expert in OLED organic material selection,
5 correct? 06:28

6 MR. YANG: Objection.

7 THE WITNESS: I have some experience
8 in this area, but I'm not a chemist. I approach
9 all this from the physics point of view.

10 BY MS. ZHONG: 06:29

11 Q. Do you consider -- have you actually
12 designed OLED organic materials?

13 A. No. I have not done -- I have not
14 designed organic materials but I've asked others
15 to design them for me, but I didn't tell them 06:29
16 how to do it.

17 Q. So you basically just provided the
18 performance criteria and hope that others will
19 be able to hit those performance criteria?

20 A. Partially, but also I would tell them 06:29
21 to change some of their electrical properties to
22 facilitate certain functions.

23 Q. So -- but you have -- have you ever
24 suggested what particular additives to use and
25 what chemicals to use? 06:30

1 A. During my experience at -- early days 06:30
2 with Hewlett-Packard Labs, we would work with
3 chemists and I would ask them to modify the
4 electronegativity or the electropositivity of
5 the molecular structures either in small 06:30
6 molecules or in polymers, and the chemist will
7 go and do it and give me samples.

8 Q. But you are not the person who is
9 going to be suggesting the chemical structures
10 of the materials, correct? 06:30

11 A. I'm not a synthetic chemist. I would
12 say I would like to have a hole-transport layer
13 that has an ionization potential of this versus
14 that. Can you do this thing for us?

15 Q. Do you consider yourself to be an 06:31
16 expert in the chemistry of the OLED stack?

17 A. I understand the physical functions
18 and the physical properties of the
19 hole-injection layer, the hole-transporting
20 layer, they're -- all the interfaces are 06:31
21 playing, both electronically as well as
22 photonicallly.

23 In other words, from the point of
24 view of electron transport, I understand that
25 because that was my expertise when I was working 06:32

1 earlier on in my career. Photonically, in other 06:32
2 words how the photons are emitted, I understand
3 this process too. But how is this related to
4 chemistry I'm not considered an expert in this
5 area. I understand it and I can converse it but 06:32
6 I'm not an expert.

7 Q. Do you consider yourself to be an
8 expert in the structural requirements of the
9 organic material in order to meet certain
10 performance requirements? 06:32

11 A. Sorry. I missed one word, the
12 structure of --

13 Q. Do you consider yourself to be an
14 expert in the structural requirements of the
15 organic materials in order to meet certain 06:32
16 performance criteria?

17 A. In some cases. I mean, I understand
18 that the -- for instance, the lithium quinolate
19 cannot transport holes by itself, right? I can
20 argue why crystallinity could be positive or 06:32
21 negative to the structure, the relation between
22 the energetic levels, the electron affinity and
23 the ionization potential and the role they're
24 playing. I understand these things, the work
25 functions for the metals and the relation to 06:33

1 injecting electrons or injecting holes. I 06:33
2 understand these things.

3 That was part of my expertise in my
4 earlier on career. But also besides that, I'm
5 also an expert of how you put the whole display 06:33
6 together in manufacturing line.

7 Q. Are you an expert in the -- the type
8 of organic moieties that's needed in order to
9 increase or decrease crystallinity transport
10 properties and others? 06:33

11 A. You know, some of those things
12 everybody knows. The more planar the molecule
13 is, the higher the propensity for crystallinity
14 and adding long chains, alkyls and the like
15 introduce visibility and amorphous behavior. 06:34
16 Adding, you know, active moieties like amines
17 and the like facilitate -- or carboxyl units
18 facilitate hole transport, where adding diazoles
19 and the like are facilitating electron transport
20 and emission. 06:34

21 But, you know, in truth I'm not
22 really -- I've learned this thing by osmosis, by
23 working with the chemists over the years. So
24 when I look at a compound, I will tell you, oh,
25 that's a hole-transporting material or that's an 06:34

1 electron-transporting material, but there is a 06:34
2 huge class of materials that is hard to tell
3 what they can do. So I cannot opine on
4 everything.

5 Q. So would you consider yourself to be 06:35
6 an expert in the chemistry of OLED?

7 A. In the chemistry of OLEDs, no, I'm
8 not an expert in the chemistry of OLEDs, but I
9 know a lot of stuff there. But I'm not an
10 expert. 06:35

11 Q. And to be clear, for your expert
12 report you only reviewed the documents that's
13 given to you by counsel, correct?

14 MR. YANG: Objection.

15 THE WITNESS: I reviewed the 06:36
16 documents that were given to me. How I
17 organized it and how I compiled it probably had
18 to do a little bit with my previous knowledge in
19 relation to how Samsung evolved -- Samsung has
20 published a lot of information. So I had a 06:36
21 slight bias on this.

22 BY MS. ZHONG:

23 Q. You did not talk to any of the
24 Samsung engineers?

25 A. No. 06:36

1 Q. You did not ask for any additional 06:36
2 documents?

3 A. No. I think you asked me this
4 earlier this morning.

5 Q. I just want to confirm. 06:36

6 A. Yeah.

7 Q. And you did not check to see -- you
8 did not ask for the process documents that
9 relate specifically to the accused products and
10 process? 06:37

11 MR. YANG: Objection.

12 THE WITNESS: I have only seen these
13 documents that they have to do with the
14 process -- I have not seen other documents from
15 Samsung. 06:37

16 BY MS. ZHONG:

17 Q. And you have not made any
18 quantitative determination in your report as to
19 how each of the process features would affect
20 the color gamut efficiency or lifetime, correct? 06:37

21 MR. YANG: Objection.

22 THE WITNESS: There is a little bit
23 of quantitative analysis [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] k 06:38

1

█

█

█

█

█

█

█

█

█

█

█

13

BY MS. ZHONG:

14

15

16

17

18

19

20

21

█

23

24

25

Q. So, first of all, your report does not provide a number as to the percentage of improvement?

06:39

A. Correct. Yes. In that sense, I agree. This analysis is not really quantitative. It's obviously more qualitative and less quantitative, but it talks about the

06:39

enabled, .

For instance, I know that inkjet printing today cannot even come close to 300 for -- this is for RGB coating, right. But

06:39

1 [REDACTED] do this, and that's one of the 06:39
2 main reasons that this technology is ahead of
3 inkjet printing. That's quantitative, right.
4 But, again, I'm not an expert on [REDACTED]
5 technology. It's just I'm impressed with the 06:39
6 way that they're -- they have perfected this.

7 Q. And we have established that the RGB
8 [REDACTED] does not apply to the QD-OLED
9 TVs or monitors, correct?

10 A. Well, I think what I said earlier is 06:40
11 how -- I'm pretty sure [REDACTED] are used in
12 putting down the organic layers. What degree of
13 [REDACTED] is used or not used,
14 I don't know. This thing was not disclosed to
15 me. 06:40

16 Q. Okay. The QD-OLED TV do not use [REDACTED]
17 [REDACTED], correct?

18 A. I don't know -- it's a different
19 technology than the [REDACTED] that
20 that is used in mobile phones. 06:40

21 Q. And you have no evidence that the [REDACTED]
22 [REDACTED] you have discussed in your
23 report is used in the QD-OLED technology,
24 correct?

25 A. Such information was not disclosed to 06:41

1 me. 06:41

2 MS. ZHONG: Okay. How much time do
3 we have on the record right now?

4 THE VIDEOGRAPHER: One moment.

5 We are at seven hours and 13 minutes. 06:41

6 MS. ZHONG: I will pass the witness.

7 MR. YANG: No questions for me.

8 Thank you for your time.

9 THE WITNESS: Thank you.

10 MS. ZHONG: Thank you. Have a nice 06:42
11 evening.

12 THE VIDEOGRAPHER: Let me get you off
13 the record. This will conclude the deposition
14 of Homer Antoniadis, PhD. The total number of
15 media units used in the deposition was six and 06:42
16 will be retained by Veritext Legal Solutions.
17 We are off the record at 6:42 p.m. Pacific
18 Daylight Time.

19 (Whereupon, the proceedings concluded
20 at 6:42 p.m.) 06:42

21 * * * * *

22

23

24

25

CERTIFICATE OF REPORTER

STATE OF CALIFORNIA)

) SS:

COUNTY OF LOS ANGELES)

I, Monice K. Campbell, a duly
commissioned and licensed court reporter, Los
Angeles County, State of California, do hereby
certify: That I reported the taking of the
deposition of the witness, Homer Antoniadis,
PhD, commencing on Wednesday, June 4, 2025, at
9:18 a.m.;

That prior to being examined, the
witness was, by me, duly sworn to testify to
the truth. That I thereafter transcribed my
said shorthand notes into typewriting and that
the typewritten transcript of said deposition
is a complete, true, and accurate transcription
of said shorthand notes.

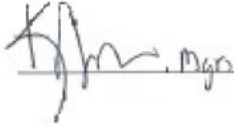
I further certify that I am in no way
related to any of the parties, nor am I in any way
interested in the outcome thereof.

() Review and signature was requested.

() Review and signature was waived.

(X) Review and signature was not requested.

1 IN WITNESS THEREOF, I have hereunto set
2 my hand in my office in the County of Los Angeles,
3 State of California, this 10th day of June, 2025.

4
5 
6

Monice K. Campbell, CCR No. 14171

HONG (ANNITA) ZHONG, ESQ.

hzhong@irell.com

June 10, 2025

RE: Pictiva Displays International LTD v.

Samsung Electronics Co., Ltd., Et Al.

6/4/2025, Homer Antoniadis, PhD, (#7353095).

The above-referenced transcript has been completed by Veritext Legal Solutions and review of the transcript is being handled as follows:

___ Per CA State Code (CCP 2025.520 (a)-(e)) - Contact Veritext to schedule a time to review the original transcript at a Veritext office.

___ Per CA State Code (CCP 2025.520 (a)-(e)) - Locked .PDF Transcript - The witness should review the transcript and make any necessary corrections on the errata pages included below, notating the page and line number of the corrections. The witness should then sign and date the errata and penalty of perjury pages and return the completed pages to all appearing counsel within the period of time determined at the deposition or provided by the Code of Civil Procedure. Contact Veritext when the sealed original is required.

___ Waiving the CA Code of Civil Procedure per Stipulation of Counsel - Original transcript to be released for signature as determined at the deposition.

___ Signature Waived - Reading & Signature was waived at the time of the deposition.

Page 299

1 ___ Federal R&S Requested (FRCP 30(e)(1)(B)) - Locked .PDF
2 Transcript - The witness should review the transcript and
3 make any necessary corrections on the errata pages included
4 below, notating the page and line number of the corrections.
5 The witness should then sign and date the errata and penalty
6 of perjury pages and return the completed pages to all
7 appearing counsel within the period of time determined at
8 the deposition or provided by the Federal Rules.
9 _X_Federal R&S Not Requested - Reading & Signature was not
10 requested before the completion of the deposition.

[& - 2003]

&	198:19,23	148 3:16	193:25 227:25
& 2:8,13 3:12	222:10 231:12	14th 56:23	228:2,3,5,19
5:12 299:24	264:4 299:3	190:19	263:23 268:13
300:9	10,000 158:12	15 52:6 59:6,10	200 11:7 44:14
0	10/1/01 194:10	164:9 198:19	48:13 85:3
	194:16,19,23	198:23	2000 9:1,10
00075653 3:12	100 3:10 38:12	16 183:19,20	23:5,7,8,11
104:15	42:21 43:1	184:11,11	37:2 38:25
00075692 3:12	57:21 61:20	193:10	39:1,4 42:6
00076087 3:17	99:21 115:16	17 86:20	48:10 60:8
148:11	143:18 144:8	133:13	61:14,18,19
00076092 3:17	161:23,24	18 47:5 150:7	63:13 96:23
00076984 3:10	186:3 187:4	182:24 193:13	111:19 112:6
00077007	189:16 203:11	1800 2:9	112:16 176:19
124:22	205:15 269:16	182 3:18	234:14,19,19
00077057 3:10	270:20 276:11	19 193:16	234:21,25
00495 1:6	104 3:11	193 71:9	259:16 268:8
00532 4:24	10th 298:3	1992 10:15	269:19
007-1007 186:9	11 183:16	1994 59:1	2000s 12:19
186:18	193:6	1:13 111:14	99:11 143:4
0076984 100:14	1109 2:14	1:18 112:13	176:22
01 189:3	116 3:13	1a 78:14,18	2001 47:25
190:19	12 25:7	1b 78:14,18	48:6 141:15
1	13 296:5	1st 184:1	184:2,8 192:9
	132 3:14	193:17,25	193:11,14,17
1 3:7,8 4:16	14 159:24	2	193:20 199:19
71:8 78:10,11	160:2 183:1,9	2 3:9 25:6	221:1,10 234:7
78:14,15 184:8	183:13 184:18	70:24 71:1,10	234:12 256:22
192:9 193:11	186:10 191:8	71:11 105:12	2002 23:12
193:14,20	193:4,5,7,8	105:16 106:16	63:13 141:15
194:10 199:21	199:10 225:16	107:13 150:3	221:1,10 223:9
200:7 238:18	233:22 245:16	183:20 188:19	2003 47:13
238:19 300:1	14171 1:24	20 23:4 101:13	48:1,6,10
1/10/01 192:19	5:22 298:6	143:17 164:9	112:2,5,5,7,16
10 52:6 59:7		193:19,19,24	113:4
99:13 159:18			

[2005 - 6/4/2025]

2005 9:1 15:8 19:25 20:2 59:12 60:8 112:24 113:2,4 121:10 2006 59:16 60:9 61:19 121:16 182:22 285:5,21 2007 285:5,21 2012 60:10 61:14,18 2015 59:16 225:16 2016 60:13,14 2017 152:16 2018 129:5 2020 107:10 109:3 2024 6:22,23 54:19 58:20 2024/01222 182:23 2025 1:17 2:2 4:2,8 55:8 224:17 297:11 298:3 299:3 2025.520 299:9 299:12 206 2:15 21 193:19,24,25 210 2:14 22 86:21 193:19 194:1,2	23 193:20 194:1,2 195:20 24 23:4 192:14 232:21 240 156:13 25 110:24 111:2 185:18 186:11,12,13 186:14 187:13 192:7,7 194:4 194:8 215:14 248:11 252:11 268:13 25505 298:6 26 188:16 194:9 27 194:13 277-1010 2:10 28 194:16 29 147:20 2:23 1:6 2:24 4:24 2:36 163:6 2:54 163:9	189:3 194:19 194:21 234:7 300:1 300 294:24 30th 234:12 31 126:10 310 2:10 312 1:24 32 194:22,24 34 194:25 35 143:17 36 195:3 38 195:5 256:20 274:23 389 182:21 256:4,8 274:15 274:22,24 277:8,11,23 3m 227:3	192:2,7,16,17 193:3 195:9 294:2 42 101:16,17 195:16 294:2 44 195:16,17 45 109:21 110:1,13 195:17 46 195:17 47 195:17 48 195:17 49 195:17 4th 4:7
			5
			5 3:13 116:5,8 116:10,17 159:24 160:2,3 160:4 5.31 120:7 5.32 120:17 50 14:4 107:25 156:13 195:17 51 195:17
			6
	3 3:10 25:6 73:17 100:10 100:13,20 105:17,20 106:7,16,20 113:3 149:19 188:19 30 59:4 110:10 124:12,24 125:20 147:5	4.3.5.1 119:20 120:1 4.6 14:9 4.6. 14:9 40 190:10,12,18 190:23,25 192:15,17,17 193:2 195:9 41 98:18,24 190:9,10,13	6 3:3,14 15:5 25:7 47:4 72:9 72:16,16 73:16 105:9,11 132:2 132:4,7 184:20 227:24 228:16 228:17 6/4/2025 299:5

[60 - achieving]

60 158:5 60/90 156:24 158:5 61 72:10,19 62341 160:6,18 659 109:24 66 72:10,19 73:16	80 128:24 129:5,8 83 150:6 85 156:11,11,12 85/85 156:17 156:23 157:1 157:10,12 8th 199:19,24	a a.m. 2:3 4:3,6 52:11,14 297:12 abandon 25:18 65:1 abandoned 220:2 ability 12:22 37:20 70:12 able 43:17 114:15 178:13 191:7 226:8 288:19 above 120:20 157:13,25 184:8,13 189:3 193:10,13,16 193:20 194:9 194:10,16,19 194:22 234:10 249:13,14,19 249:22 299:6 absorb 73:5 139:23 absorbs 286:11 accelerate 25:13 28:15 198:8 accelerated 24:22 158:9 160:9,10 198:11 acceleration 28:17	acceptable 126:2 acceptor 176:9 176:10 access 39:8 147:23 155:17 209:24 210:10 212:1 227:10 account 168:25 accuracy 98:13 142:13 145:11 151:20 294:5 accurate 99:6 99:19 135:10 143:16,18 144:1 145:9 150:16 297:18 accurately 88:19 98:21 145:12 146:12 246:2 accused 69:22 70:20 97:13 284:18 293:9 accusing 240:16,19,23 250:9 achieve 13:16 43:8 114:5 120:19 145:8 278:2 achieved 99:15 achieving 11:21 108:3
7	9		
7 3:16 73:17,17 148:4,7,9 185:1,1 186:18 199:10,14 233:25 245:13 245:16 7,321,193 3:9 70:25 71:15 70 129:8 71 3:9 119:17 119:22,24,25 7353095 1:25 299:5 75658 105:10 105:15 7607 149:3 77,000s 101:10 7700 101:4 77000 101:1 77003 101:3,12 78 3:7,8	9 14:22 183:20 185:1 187:2 189:3,4,5,5 9.2 14:10 90 109:25 110:3,13 125:21 158:5 900 2:9 143:11 90067 2:9 905-7000 2:15 90s 21:22 40:11 42:1,1 68:20 69:2,7 133:4 177:9 252:22 91 107:4,7,9 92 10:15 93 59:3 94 10:12 59:12 95 95:5 213:21 224:15 97 224:16 98 125:17,18 98101 2:15 99 69:2 176:19		
8			
8 3:18 95:15 182:9,11,20 187:2 202:5			

[acknowledge - al]

acknowledge 106:5 107:10	48:1 57:9,11 84:7 86:2 89:1	addressing 278:10	ago 29:15 42:23 54:8,15
acquire 263:25	89:8 90:15	administer 5:18	55:5 143:17
acquired 59:24 146:21,22 264:11 265:11	96:16 97:4 101:2,5 108:13 108:17 109:9	admiring 183:10	185:8 192:14 192:14 227:14 269:15
acquiring 141:16 263:22	136:9 143:23 146:12 166:3	adopted 85:14 283:20	agree 4:15 38:2 47:10 62:6 64:5,7,10
acquisitions 264:2,4	183:1 197:12 213:21 223:23	advantage 109:8 130:17	82:18 93:15 103:3 107:9 135:11 229:21
acrylate 203:3 207:4	230:21 239:9 243:23 246:11	131:2,3,9 145:10,15	229:23 230:5 263:6 294:18
act 177:19	250:18 277:22 281:23 286:15 288:11	advertised 12:10,11	agreed 62:11
action 1:5 5:5 60:16 121:20 139:15	ad 25:16	affect 40:23 85:10,19 128:7	agreement 260:21 265:24
active 23:20 46:4 214:6 291:16	adapts 76:21	168:11 171:6 226:17 293:19	agreements 65:25 260:17
actively 9:12	add 162:5 204:21	affecting 40:13 86:10 87:4,19 88:11 107:16	ahead 8:14 18:17 27:19 52:14 61:7
activities 11:4 22:18 62:4 218:15 220:8 223:7	added 18:13 adding 291:14 291:16,18	affects 43:21 89:1 99:8,9	66:16 70:10 113:17 114:12 117:25 126:17
activity 34:17 36:1 218:16 219:18 222:3 227:2,3,4	addition 17:22 180:8 201:21	affiliations 5:10	126:17,18,18 149:8 181:12 190:2 208:24
acts 160:8	additional 147:16 214:17 293:1	affinio 224:2	217:7,7 222:7 239:6 241:6,23 256:16 295:2
actual 10:14 16:7,15 119:9 249:2	additive 130:25 247:19	affinito 41:24 210:23 211:9 211:21,22 214:3,5 224:3 224:3 235:18	aib 21:12
actually 8:6 13:7 26:13 39:24 47:1,3,6	additives 288:24	affinity 290:22	air 173:9
	address 99:1 170:2 218:13 218:23	affinos 224:2	al 4:20,21 299:4
		aging 160:9 168:24	

[alignment - applications]

alignment 89:3 90:14 103:5 294:10	177:15 178:10 179:7,16 291:15	anodes 36:15 36:22	appear 13:25 84:21 158:18 190:13 191:2
alignments 89:3	amount 152:20	answer 8:15 18:17 30:4 35:17 37:7,16 53:24 54:5 61:7 65:3 66:16,23 69:19 86:7,23 129:19 154:13 157:8 159:6 165:16 179:6,19 180:7 208:24 241:6 250:4 263:16 268:1 270:20 272:16,21 273:6 274:1	appearance 5:8 appearances 2:6 5:10 appeared 183:2 appearing 299:18 300:7 appears 110:21 167:11 apple's 270:8 applicability 100:2 applicable 224:5 application 24:15 25:6,14 26:5,6,12,21,24 27:12,15 28:4 28:15 62:23,25 63:10 67:20 74:3 85:5 90:20 91:2 127:6 135:15 136:19,20 153:5,21 156:22 160:13 160:14 229:5 242:21 246:10 246:12 applications 12:5 15:16 26:16 42:20 43:4 51:24
alkyls 291:14	amplifying 173:1		
allow 114:8 131:10 172:25	analogous 93:19 230:14		
allowance 62:22	analogy 74:11 144:3		
allowed 112:7 112:16 129:19 266:7	analysis 105:1 123:9 150:8 256:12,24 265:5,10 275:17 277:17 277:18 278:23 279:17 293:23 294:18		
allowing 236:9 237:19		answering 250:5 275:8	
allows 51:25 220:4	analytical 124:4	answers 57:14 117:1 175:11	
almond 74:11 74:12	analyze 121:22 121:25 151:5 168:9	anton 183:21	
alternating 40:2 43:16 278:1	analyzing 150:2	antoniadis 1:16 2:1 3:2 4:17 5:24 6:9 296:14 297:10 299:5	
alternative 148:1	angeles 2:9 297:4,8 298:2	anybody 245:21 247:2	
aluminum 177:9	annita 2:8 5:12 287:2 299:1	anyway 129:21 212:19	
amazing 189:17	annotative 253:13	apparent 49:8 221:4	
ambient 43:7	announced 129:13	apparently 84:9 126:12	
ambivalent 64:17	anode 98:22 99:4 174:13		
america 1:8			
amines 291:16			
amorphous 169:20 177:5,8			

[applications - attorney]

74:2 246:8 247:21 255:24 258:6,18 applied 41:8 46:17 50:5 68:5 106:12 115:12 129:10 221:5 282:1,10 282:12,15 apply 46:23 64:22 128:11 129:17 155:12 276:10,19 280:12 295:8 applying 136:3 145:5 146:18 204:16 228:5 approach 8:21 17:23,23,24 33:4 38:10 46:17 68:1 113:23 218:18 226:2 288:8 approaches 18:7 120:19 121:2 155:6 233:11 approaching 66:24 98:5,6 215:7 287:4,12 appropriate 261:23 approval 27:15 27:23 197:18 197:19,21	198:14 approved 197:9 approximation 143:21 april 56:5 58:4 area 20:18 22:8 22:12,14 43:14 58:23 96:23 127:5 136:17 144:1 146:3 150:22 151:1 152:3 204:5,7 206:6 208:8,20 209:3 225:7 226:10 239:9 242:18,19 253:18 255:5,8 267:12,13 281:4 282:22 287:23 288:8 290:5 areas 23:21 32:18 41:5 73:7 123:1 131:1 135:8 142:23 146:13 154:15 204:11 205:20 207:5,9 210:17 211:3 213:12 227:7 227:21 230:15 253:13,13,25 255:7 275:1,21 276:24	arena 223:5 argue 64:5 290:20 argument 135:18 247:22 arrangements 91:21 295:17 array 206:12 arrhenius 158:21 arrows 102:3,4 art 39:23 61:14 61:18 63:5,8 63:16,21,22 68:6 69:12 70:8,15 214:4 239:13 241:11 245:22 247:3 247:13 250:21 251:8 252:7 253:3,8 275:2 277:11,14,19 277:22 279:5 ash 209:14 asher 209:13 asia 223:4 asked 29:25 31:7 56:16 58:1,11,13 61:24 77:22 81:2 121:21,24 121:25 122:4 147:25 239:20 287:18 288:14 293:3	asking 8:10 66:11 75:16 86:8 130:7 157:1,8 172:9 246:18 262:1 271:9 275:8 aspects 61:11 79:16 165:7 asserted 58:19 assess 24:7 154:22 assessed 65:6 assessing 61:23 77:22,23 assessment 79:15 135:12 211:4 277:10 assigned 8:4 114:2 associated 108:23 assume 138:15 213:20 assuming 166:6 assumption 12:18 87:14 atomics 227:4 attempt 119:14 attempting 149:13 attention 12:5 101:18 attorney 5:11 26:22,23 27:5 27:12 28:3
--	---	---	--

[attorney - beginning]

55:19 129:22 attorneys 23:25 24:5 26:6 55:15 56:9 198:1 239:19 attract 229:2 attractive 13:8 attributable 169:9 atypical 157:3 audio 4:13 august 190:19 authors 117:3 117:6 automotive 12:4 156:25 157:19 160:17 availability 56:10 58:4,9 available 55:25 56:5,11,19,20 79:12 80:9 86:6 223:14,23 248:24,25 255:16 avenue 2:9,14 average 249:14 249:19,22,24 avoid 67:8 179:8 207:22 213:11 214:23 215:10,23 216:10 217:19 276:24	avoiding 215:19 275:21 aware 20:3,13 63:4,25 73:1 217:17 230:24 230:25 231:4 237:5 241:10 245:7,21 247:2 248:2 250:8,15 250:17,20,21 253:8 259:17 259:25 aziz 138:24 139:1 b b 3:5,8 78:11 300:1 bachelor's 254:4,15 back 6:14 31:20 37:2 39:16 41:9 52:13,16 59:19 68:16 110:24 111:13,16 141:21 163:8 184:18 186:10 193:4,8 199:21 220:7 224:14 231:19,22 245:14 252:11 254:13 background 10:7,8 20:25 21:16 22:20	26:10 31:16,22 32:19 50:10 132:23 133:9 228:22 235:10 241:8 244:5 backplane 167:1 174:10 174:11 balance 85:10 119:2 168:12 171:7,14,21 174:21,25 balances 83:11 balls 144:6,7 bare 204:20,22 barely 232:9 barrier 155:2 155:12 202:6 208:8,19,21 209:9,17 210:5 212:22 226:24 barriers 140:2 205:24 based 10:25 12:9 17:9,10 17:15 47:7 51:21 64:2 69:12 79:15 106:23 111:23 112:2 113:12 128:19 129:7 147:17 159:8 168:12 210:20 211:4 219:20 221:21 226:4	245:25 258:20 277:9,11,24 293:23 baseline 125:23 125:25 bases 254:2 basic 268:16 basically 16:17 22:5 54:15 83:2 89:17 110:18 145:22 161:14 196:20 196:23 208:18 209:8,17 211:7 221:6 222:4 226:18 270:4 277:17 285:12 288:17 basis 277:6,21 basket 144:7,8 basketball 144:6 bates 105:9,14 148:10 187:13 battelle 39:5,7 39:11,21 41:20 42:9,13 210:24 211:1,9 214:2 214:3 217:11 217:13 224:4 235:19 247:17 beginning 5:11 67:5 118:17 128:2 222:25 262:8 278:9
---	--	--	---

[beginning - brings]

286:1 begins 106:10 behalf 5:15 6:15 7:15 behave 224:24 behavior 45:18 169:18 291:15 believe 6:19 8:1 8:5 9:25 14:16 19:5 21:17 29:14,21 36:10 36:24 64:19 86:20 92:24 99:14 101:3 111:21 120:18 125:6 132:24 135:4 150:1 156:22 176:1 242:20 244:21 246:1,15 249:18 251:21 264:19 275:5 282:19 believed 12:19 180:22 224:16 252:8 belong 189:21 belongs 191:16 bend 33:18,21 33:21 benefit 108:21 benefits 61:4 benjamin 71:16,18 254:25	best 35:1,7 70:11 90:24 135:16 212:23 218:7 243:10 better 7:21 52:20,23 53:1 111:2 113:19 125:15 126:14 130:24 131:7 136:12 138:4 151:5 170:11 177:14,18 178:16 284:5 beyond 266:23 bias 292:21 big 228:4 281:15 bigger 95:10,12 150:7 258:21 biggest 131:2 bit 9:1 52:3 57:9,12 104:5 120:22 121:14 122:9 135:5 142:1 146:25 148:19 150:16 156:21 164:12 164:16 172:25 173:1 175:24 218:21 220:8 228:21 235:10 266:22 285:25 292:18 293:22 black 108:2,6 110:14	blanket 127:6 153:4,21 203:19 204:18 212:10 229:12 blanketly 276:23 279:1 blend 179:7 blended 51:3 118:25 blind 274:7 blindly 272:17 block 43:8 110:11 blow 72:15 blue 13:25 45:11 49:3,24 50:24 67:14,22 84:13 87:9 88:20 93:12,21 94:6,7 98:8,22 99:20 102:3,4 113:13 119:15 120:13 125:15 125:23 142:2,5 144:16 168:24 255:10 blurred 183:22 boards 144:10 boe 268:8 269:21 270:6 boe's 269:24 boes 268:4 269:5 book 184:25 185:11,15	189:8 books 29:20 189:8 bother 133:24 bottom 201:14 201:16 238:19 boundaries 179:24 box 7:6 boxes 189:9 bracket 116:12 116:13,21,22 201:17 brag 109:4 237:8 brain 176:16 219:9 brainstorming 219:10 bread 34:14 break 52:4,5 57:11 111:5,8 163:2 231:12 brief 21:21 112:11 261:6 brightness 98:15 162:11 bring 71:2 124:9 178:11 247:22 bringing 117:11 brings 97:25 99:7 110:23 125:21 182:13
---	---	---	---

[brings - cdt]

183:11 brought 22:6 122:23 170:4,7 bsd 254:10 build 13:19 16:18 19:16 45:1 48:18,24 49:23,25 97:3 141:19 168:8 225:4 259:6 building 48:21 49:22 95:15 141:22 157:16 222:16 built 167:11 169:25 214:15 bulb 77:11 bulk 69:24 bullet 106:8 228:14 229:10 229:22 burning 125:14 bury 226:13,17 business 128:17 258:1 262:6 270:5 busy 283:15 butter 34:15 buy 223:16 248:23 buying 262:22	ca 1:24 299:9 299:12,21 cadmium 267:9 calibrate 7:21 52:20,23 california 2:4,9 5:22 17:10,16 297:2,8 298:3 call 166:25 212:19 275:14 called 11:16,22 22:9 41:24 42:2 105:21 106:13 110:2,9 158:8 212:18 267:3,12 calling 211:19 calls 200:4 202:12 243:17 cambridge 21:2 21:10 65:22 66:2 235:11 259:19 camera 4:10 campbell 1:23 2:3 5:21 297:6 298:6 canceled 55:12 capability 11:11,12 46:16 140:1 175:3 capable 61:23 77:21 92:8 capacitor 227:8	capacitors 42:20 227:6,18 capacity 84:4 85:8 86:1,20 95:6 105:4 269:16 283:3 capture 116:14 carboxyl 291:17 care 46:8 227:7 253:25 cared 46:9 career 290:1 291:4 careful 40:22 carefully 67:7 146:25 202:3 209:1 229:20 carried 286:15 carrier 74:10 carrying 199:15 234:1 235:5,20 244:6 case 4:23 6:19 7:4,15 12:8 43:18 64:6 66:8 75:1,2 76:5,17 77:1,3 77:5,6 138:18 138:20,22 156:11,11 177:21 178:21 180:13,14 182:1 204:21 232:20 243:14	257:25 262:16 272:8,9,9 273:15,20 285:2 cases 28:6,19 49:20 64:4,5 64:14,20,23,24 74:25 75:14 77:20 84:8,17 85:6 158:1,4 158:10,15 177:18 178:9 178:15 181:10 181:23 202:16 205:8 232:17 232:18 258:6 258:12 290:17 cathode 36:16 37:10,14 38:7 43:21 76:25 98:23 174:14 176:2 179:9 181:16 cathodes 36:15 36:21 38:5 180:15 caution 7:13 55:14 56:7 165:15 239:18 caveat 175:8 ccp 299:9,12 ccr 1:24 298:6 cdt 21:2,9 235:11 236:13 236:17,19
c			
c 101:19 102:5 102:8,14 156:11 158:5			

[cdt - clarify]

259:5 cell 91:19 93:3 93:4 certain 56:18 62:3,4 67:14 79:22 80:23 84:22 92:10 110:6 124:11 129:17 157:17 164:18,22,24 165:1,7 173:3 220:18 226:25 238:21 245:20 264:22 276:24 278:2 288:22 290:9,15 certainly 103:10 certainty 100:6 certificate 297:1 certified 2:3 5:21 certify 297:9,20 cetera 19:18 24:10 27:23 69:5 105:12 208:21 253:15 cf 103:1 chain 206:17 208:5 chains 291:14 challenge 51:1 224:19	challenged 65:10 challenges 145:4 224:21 224:22 challenging 216:21 chamber 40:13 41:14,15 172:18 217:15 230:4 chance 8:11 47:8 92:6 134:19 change 53:21 58:14,15 76:22 77:8 170:20,22 171:18,22,23 175:9 288:21 changed 56:12 236:21 changes 168:22 168:23 180:14 changing 58:6 68:17 69:3 72:23 73:3 74:10,13 138:9 charge 85:11 168:12 171:7 174:21 180:10 charges 161:6 168:17 171:12 charlie 22:1,4,9 201:5,8 211:19 238:20	charlie's 187:5 187:24 chat 7:6 133:22 cheaper 12:20 check 86:15 148:19,23,24 247:14 293:7 chelates 268:20 chemical 170:25 171:1 276:21 282:5 289:9 chemicals 288:25 chemist 151:3,5 288:8 289:6,11 chemistry 69:9 152:1 289:16 290:4 292:6,7 292:8 chemists 289:3 291:23 chip 214:14 chocolate 74:11 74:12 choice 281:10 chronological 201:15 circle 108:20 circuitry 167:12 170:22 circular 107:1 107:23,24 108:1,1,4,9 110:2,7,9	circumstances 257:25 272:11 cited 100:25 101:3 civil 1:5 299:19 299:21 claim 53:14 63:7 67:10,25 69:11 70:2,2 255:20 257:1 277:16,16 claimed 41:22 41:25 241:1 242:20 251:25 280:17 281:4 claiming 53:1 66:3 67:2,12 67:21 197:4 238:4 252:1 257:14 275:6 claims 26:25 53:3,11,12,17 62:20,22 63:8 64:23 68:21 69:13,16,21,24 70:4,5,6,12,20 145:7 196:8 250:17 256:4,8 275:15 277:14 284:10 clarification 113:19 280:4 clarify 18:1 141:25
--	---	--	---

[class - comment]

class 292:2	coatable 204:4	collected 245:6	223:2 285:6,19
classes 285:11	coated 204:10	collection 81:1	293:20
claus 71:16,18	228:6 286:20	color 12:10,24	colored 109:19
clean 215:11	coater 224:5	13:4,4,7 14:1	colors 11:25
216:17 274:25	coating 11:19	48:15,25 50:4	17:4,6 114:16
cleaner 136:6	11:22 45:12	50:5 51:17,21	260:6 294:6
cleaning	135:17 140:16	67:9,16 68:17	column 72:9,16
210:17 212:16	202:10,16,18	68:25 69:3	73:16,17,17
214:10 215:8	202:22 203:3,8	72:23 73:3	combination
clear 102:25	203:18,23	74:10,13 81:17	90:2 110:8
145:10 148:2,2	204:15 205:18	84:15 87:5,7	252:4
171:10 264:19	206:3 207:6,15	87:10,19 88:16	combine 49:8
274:3 292:11	210:19 212:10	88:18 90:12	combining 49:2
clearly 100:7	213:11,19	92:12,12 93:6	255:9
138:3	217:14,19	93:16,17 94:17	come 24:3 30:5
click 71:12	229:12 260:5	94:18 95:7	48:11 66:5
client 55:19	281:4 294:25	97:24 98:5,11	76:5 181:15
128:22 129:15	code 160:18	98:12,14 99:8	205:4 213:17
129:22	299:9,12,19,21	99:22 102:8,17	251:11 294:24
clog 154:1	coexist 167:19	102:22 103:2,4	comes 17:7
clogging 154:2	168:6	103:19 104:4,4	30:4 42:22
close 12:11	cofounder	104:5,6,9	44:12 76:2
15:1 22:5	132:20	106:11,20	124:15 155:25
59:16 137:20	coinventions	107:4,12,16,19	171:14 235:1
178:11 249:17	246:6	108:10,13,16	coming 113:22
250:7 294:24	coinventor	108:17,23	185:21 287:3
closer 181:15	244:22 246:16	110:15,17	comma 202:2
cmos 214:15	coinventors	113:12 114:1,9	commencing
coached 57:11	243:23	114:18 115:3,6	297:11
coat 43:13	collaboration	120:3,6,7	comment
204:9,13,24	265:21	123:13 124:6	107:14 148:23
205:2,6,6,8,14	colleague 17:18	142:16,17	152:8 154:5
205:16,19	colleagues	144:17 169:19	155:9 181:7
206:6,7 209:2	224:15	169:19 220:10	268:7 269:15
215:20		220:11,11	274:12 278:19

[commenting - concerned]

commenting 277:9	community 9:20	comparisons 154:5	component 11:14 271:3
commercial 221:12 261:22 270:16 281:10	companies 29:23 39:8 47:2 65:21 246:7 253:1 257:19 265:11	compensate 154:1 169:1 170:23 171:15 263:19 264:16	components 13:20 14:2 49:24 51:1 110:5
commercializ... 112:1	company 4:21 35:24 41:12 51:16 59:20 111:19 236:13 236:14 245:21 264:16 272:4 272:12,24 273:2 280:9 281:17	compensating 167:13 169:17 262:14	compound 210:15,16 291:24
commercially 39:16 82:7 83:3 221:19,21 248:24 278:25 279:11	company's 272:5,13	compensation 169:5 259:24 263:2	compounds 270:23 273:7 273:13 276:18
commissioned 297:7	compare 34:24 35:5 70:19 138:9 149:13 152:10 256:3 267:15 268:4 281:17	competing 245:7	compressive 102:12,13,15
committee 25:15 29:6,8 232:18	company's 272:5,13	competition 270:1,24	computer 149:2
common 24:10 35:22 109:1 140:9 180:17 180:18 198:16 271:3	company's 272:5,13	competitors 34:21 267:15	conceivable 245:6
commonalities 59:23	company's 272:5,13	compiled 292:17	conceived 236:25 242:15 243:13,14
commonly 271:12,15,18	compare 34:24 35:5 70:19 138:9 149:13 152:10 256:3 267:15 268:4 281:17	complete 154:13 297:18	concentration 177:22
communicate 54:14	compared 35:2 131:6 218:17 269:5 275:13 277:13	completed 299:7,17 300:6	concept 13:3 29:20 44:7 47:21 68:19,22 73:9 83:24 115:12,18 121:6 212:4 255:11 275:4 278:1
communicated 272:1	compared 35:2 131:6 218:17 269:5 275:13 277:13	completely 135:18 142:8	concern 129:24
communicati... 7:14 53:25 55:15 56:8 165:15 239:19	comparing 105:15 133:15	completion 300:10	concerned 38:10 92:24 120:7 239:2
	comparison 134:23 135:5 142:3 150:3,18	complex 45:9 82:25 153:23 178:7 180:9,14 270:17 272:16	
		complicated 162:12 179:22	

[concerns - converse]

concerns 120:3 201:2 conclude 277:7 277:22 296:13 concluded 296:19 conditions 67:13 156:9,18 158:2 160:16 160:20 166:14 175:6 202:3 220:19 conduct 76:23 conducted 4:9 4:25 conductivity 178:22 conferences 60:5 270:11 confidential 1:14 79:12 129:23 240:22 266:8 confidentiality 129:18,25 252:9 confinement 145:2 confirm 165:23 234:11 293:5 confirmation 166:5 confirmed 57:21,22 58:12	confirming 106:1 conflicting 55:21 conflicts 58:14 confused 94:13 conglomerate 35:13 conjunction 67:23 167:15 connection 4:11 89:18 91:5 conor 132:9 134:25 consent 27:24 consider 22:7 58:22 79:2 151:7,13 287:20,24 288:3,11 289:15 290:7 290:13 292:5 considerations 42:15 43:3,6 considered 3:8 78:5,24 123:2 203:2 290:4 considering 207:11 consist 29:1 45:10 162:15 consists 46:11 49:13 77:12 144:11 145:20	162:10 constant 168:17 173:2,4 173:5 constitute 110:2 construct 26:25 constructed 70:20 consultant 7:2 consume 222:3 consumer 157:18,24 158:4 269:12 consumes 162:17 consumption 109:8 contact 55:1 121:7 208:20 210:6 274:25 299:9,20 contacted 55:5 contacting 227:7 contacts 173:8 205:11 227:8 227:11,22 236:3,5,9 237:24 238:13 contaminating 40:12 content 232:5 contents 232:24	context 72:13 102:9,14 103:8 160:21 202:11 207:1,24 continuations 286:3 continue 4:14 52:4 111:6 121:5 134:18 168:5 continued 59:14 223:9 286:4 continuously 219:13,17 contributed 14:4,5 81:17 contributing 159:3 contribution 81:16 contributor 10:17,17,18 control 14:1 130:24 131:4,7 138:5 145:14 146:12 154:15 154:16,18 178:13 294:4 controlled 154:23 controlling 51:1 175:4 converse 142:3 290:5
--	--	--	--

[conversion - cost]

conversion	20:1,5,15	114:10,25	244:13,23
67:4,5,11	23:11 25:24	115:1,3 116:23	248:9 251:23
68:10,12,15,20	26:7,8 27:6,16	120:4,8 121:23	253:7,21 257:5
68:25 69:1	27:21 28:5	121:24 122:2,3	257:9,13,18
71:21 72:3	29:13 31:6	122:14,20	259:13,24
73:12 74:22	32:5,23 35:18	123:16 127:11	260:13 261:24
75:12 97:18	35:21 36:2,16	127:14 129:4	264:8,18 265:1
285:6,20	39:13 42:22	129:11 133:17	265:6 266:20
convert 73:5	47:12,13,16,21	135:6 139:5	268:17,24
224:7	50:20 51:21	141:24 144:22	269:2,25 270:9
converted 68:8	61:5 68:13,14	144:23 151:15	271:24 273:4
converting	68:18 69:16	157:5 158:9	273:20 274:10
67:14 73:10	70:21 71:17,21	160:12 162:4	274:17,22
161:3	71:22 72:24	162:22 165:1	275:11 277:8
convey 49:16	73:3,10 76:9	166:23 167:8	277:23 279:14
convince 47:11	77:18 78:6	169:12,24	280:1,12,21
coordinated	79:1,3,7,24	170:8 171:1	281:1,12
117:5,17	80:8,19 81:6	172:3,12,24	282:25 284:2
copies 78:21	82:10,15,23	174:10,14,18	285:7,16,21
copper 85:2	83:7,8,13 84:5	174:23 175:7	288:5 289:10
copy 78:17	86:25 87:6	175:23 183:21	292:13 293:20
corner 188:22	89:19 90:16	184:6,9 185:2	294:17 295:9
194:5 195:3,5	91:6 92:20	188:19,22	295:17,24
corporation	93:1,8,23 94:7	195:18 200:2,9	corrections
21:3,9 66:6	94:8 95:1,20	202:11,23	28:1 169:5
225:10 233:11	96:7,18 100:3	203:14 204:12	299:14,15
233:12 235:14	101:16 102:9	205:12 207:6	300:3,4
240:6 268:19	102:15 105:14	208:1,9 209:10	correctly 32:17
269:2	105:21 106:17	210:7 214:25	86:5 227:13
corporations	106:21 107:5	215:11,24	correlated
24:11	108:17,24	221:12 223:10	171:11
correct 6:11,12	110:20,24	227:18 228:7	correlation
8:4,8,19,20	111:20,24	234:7,14 235:7	171:9
15:10 17:25	112:3,19,25	241:19 242:16	cost 12:21
18:10,14 19:1	113:6,14 114:3	243:5,16	107:23 150:5

[cost - days]

212:15 costs 212:8 counsel 4:18 5:9,19 6:3 80:14,17 121:22 122:13 134:6 239:23 292:13 299:18 299:22 300:7 count 147:10 231:16 counting 47:12 county 297:4,8 298:2 couple 11:8 16:5 58:13 111:17 125:10 191:19,22 223:4 255:23 269:17 274:11 281:24 coupons 44:15 44:16 course 13:1 18:6 26:8,25 28:1 31:7 46:7 56:9 79:4 117:17 118:18 138:20 139:7 145:11 198:25 213:7 217:16 222:15 240:10 256:22 262:18 court 1:1 2:3 4:22 5:17,20	5:21 7:5 37:6 92:1 101:23 112:8 134:1 231:17 261:3 264:6 297:7 cover 205:10 213:8 254:1 coverage 66:14 covered 65:21 262:9 covering 279:13 covers 173:14 create 179:3 creative 249:8 creativity 249:19 credited 243:24 criteria 83:17 157:16 288:18 288:19 290:16 cross 101:23 109:16 202:4,5 202:15 crowded 215:7 227:2 crr 1:23 crux 237:25 crystalline 177:5,15 178:17 179:17 crystallinity 177:23 178:10 178:12,24 179:4,11	290:20 291:9 291:13 crystallize 177:12 179:25 csr 1:24 cubicles 23:10 cupertino 10:25 23:10 curable 204:23 247:8,14,16,25 248:3,5 cure 151:25 216:15 curiosity 231:6 current 97:10 160:22 161:12 166:4,4 168:19 173:2,4,5,6 currents 175:10 curriculum 3:7 customary 158:4 customer 12:12 customers 129:18 cut 183:24 225:6 cv 1:6 4:24 78:19 cycling 160:10	dangerous 150:14 dark 156:12 data 125:7 155:8,17,18 279:18,19 date 4:7 6:21 9:8 23:15 54:10 55:17,24 56:23 57:18,25 58:5,6,10,11,12 58:14 184:1 192:19 234:10 234:17,20 247:4 299:16 300:5 dated 192:9 199:18 dates 55:22 56:13,18 242:24 252:13 252:17 david 2:18 5:2 dawned 143:8 day 131:13 224:22 298:3 daylight 4:7 296:18 days 21:6 35:11 60:2 69:2 178:6 183:12 200:18 221:23 237:6 245:3 248:15 252:7 252:21 253:12
		d	
		d 3:1 damages 139:8	

[days - deposit]

254:6,13 289:1 de 116:13,22 deadlines 219:21 deal 89:1 december 113:2 decide 12:13 24:8 62:20,21 94:12 198:8 decided 14:19 15:9 28:15 56:21,23 112:24 245:10 decides 25:13 deciding 144:24 decision 12:16 15:12 26:4 27:3 declarations 28:8 decomposition 151:12 decrease 291:9 decreased 269:24 dedicated 221:24 deeper 169:20 deeply 60:7 defect 124:1 154:18 defective 120:14	defects 137:1 144:17 defendants 1:9 2:12 5:15 defended 57:9 define 145:13 157:16 162:9 167:14 168:4 179:23 defined 69:13 69:15 defining 100:8 definitely 195:8 definition 90:1 168:4 269:19 deformed 102:20 degradation 158:18,25 159:2 degree 50:8 53:6,17 109:25 110:1,13 132:25 144:23 145:2 164:11 254:4,16 295:12 degrees 109:21 110:3 156:11 156:12 158:5 delaying 110:5 deliver 12:9 13:23 84:11,14 90:24 96:20 118:23 119:15	143:11 171:20 221:6 294:11 deliverables 118:3,22 119:12 delivered 13:22 99:18 delivering 12:6 51:4 82:24 92:8 97:4 demand 138:4 253:24 demo 46:10 114:21 115:7 115:15 116:1 demonstrate 46:10,24 47:5 47:20 48:2 85:2 262:19 demonstrated 143:22 demonstrator 114:18,24 119:16 120:8 demonstrators 118:6 demos 117:19 density 49:16 department 13:2,11,13 35:16 44:25 45:2 46:8 112:18 113:4,5 113:8 117:13 141:10 257:16	departure 72:8 depending 24:19 98:23 depends 4:10 34:23 64:5,6 73:24 74:19 77:9 84:7 85:4 85:5,6 89:2 90:19,20 103:7 103:8,8 115:5 135:14,14 136:18,19 137:19 156:8,9 156:9,22 157:21 158:2 159:1 160:13 161:20,21 170:10 171:25 177:12,17,24 179:6 181:8 203:22 257:24 258:13 261:14 262:16 267:17 272:8 deponent 5:15 deposit 40:20 85:22 94:5 131:1 135:8 153:3 207:4 208:7,19 210:4 215:22 226:23 236:6 252:19 274:16 279:1 294:11
--	--	---	--

[deposited - device]

deposited 10:19 12:21,23 18:7,9 35:3,6 36:2,10,14 38:18 88:20 93:22,25 96:13 127:5 138:3 172:7 204:11 208:6 209:18 244:8 278:17	276:21 279:12 281:5 282:1,2 282:3,19,25 287:4 296:13 296:15 297:10 297:17 299:19 299:23,25 300:8,10	designation 103:2 designed 288:12,14 despite 63:8 detail 13:14 53:13 198:14 detailed 54:16 275:16 details 12:17 15:14,17 19:4 40:2,19 87:13 95:16,21 105:4 105:5 117:21 130:11 154:14 175:13 176:23 179:23 264:11 275:25 276:8 276:16,18 283:23 284:20 285:25 286:2	224:8 227:21 267:9 developed 13:3 13:3 18:10,25 19:5,19 45:24 50:12,16 98:4 154:4 169:4 262:6 developing 10:4,23 32:25 36:1 42:7,13 45:4,7,9 47:23 48:12 49:11 50:19 51:20 113:11 142:15 142:17 260:3 294:6 development 9:13,18,19,22 9:23 10:3,24 11:4,13,17 15:25 16:3,11 16:12,23 17:14 17:15,20,21 20:4 31:21 32:23 39:19 40:4 44:19 59:25 83:17,22 83:23 113:10 116:12,19 117:22 118:5,8 121:6 128:6 221:15 261:15
depositing 85:10 87:8 127:10 275:19 276:14,23 283:16 286:16	depositions 89:4 275:24,25 depth 178:19 describe 12:1 30:17 31:8 46:12 62:1 66:18 159:3 249:24	described 27:25 70:14,14 141:10 154:16 158:21 184:23 212:17 215:13 241:16 286:19 describes 121:1 242:1 describing 70:13 110:22 207:17 211:12 214:21 215:5 215:19 284:6	device 16:11,23 17:3,13,19
deposition 1:15 2:1 4:8,17,25 17:24 31:21 36:1,7 44:5 55:8,11,17,23 56:6,14,17 57:8,18,18 58:1 85:14 87:11 88:25 96:17,19 99:19 104:7 126:21 126:23 127:20 130:2 135:23 153:15 172:22 175:1,5,5,7 203:19,20 204:18 206:11 207:22 209:9 212:9 216:11 238:12 247:9	description 3:6 26:18 199:18 202:7 286:9 design 11:13 16:7,18,19 186:15 288:15	determination 279:10 293:18 determine 98:21 137:24 determined 299:18,23 300:7 detract 169:10 detrimental 40:15,17 develop 11:7 12:24 20:14 44:21,21 83:20 114:9 221:25	development 9:13,18,19,22 9:23 10:3,24 11:4,13,17 15:25 16:3,11 16:12,23 17:14 17:15,20,21 20:4 31:21 32:23 39:19 40:4 44:19 59:25 83:17,22 83:23 113:10 116:12,19 117:22 118:5,8 121:6 128:6 221:15 261:15

[device - disclosure]

43:13 53:7	172:24 218:2	160:16,18,20	directed 99:23
81:18 82:8,14	222:17,22	168:13,20,21	direction 91:18
83:22 87:5,6	devoting 219:5	172:7,8,16,23	98:10 110:6
103:9 117:22	diazoles 291:18	177:13 195:22	directions
118:8 123:8	dictated 159:19	195:24 197:17	165:9
124:5 151:10	dielectric 208:7	227:17 229:2	directly 20:10
151:11 156:2	209:9 247:9	236:14,15	45:20 49:15
156:10,13,16	difference	240:1 241:14	60:20 67:17
157:3,9 158:13	49:10 51:5	244:9 247:21	74:18 87:7,11
161:7,25 162:1	104:3 109:6	255:7 260:6	88:19 161:2
162:2,8,16,16	137:5 153:19	295:18	171:10 294:7
168:23 170:14	191:7	differential	director 117:7
171:14 173:3	different 11:25	168:24 169:1	117:9
173:23 174:17	16:10 17:4,4,5	169:18	disagree 62:7
174:17 179:12	17:5,6 22:18	differentiation	disclose 233:13
181:2,4 196:8	29:22 32:18,20	171:23	247:8 280:11
210:3,10	33:3,4,6 34:1	differently	disclosed 85:18
211:25 221:19	35:4 41:5,14	165:24	90:7 91:9 94:1
222:13 226:17	45:13,25 49:4	difficult 55:21	125:9 150:23
269:11 273:11	49:5 66:11	58:5,17 65:3	164:25 233:10
278:11	67:1,16 73:11	98:19 143:9	240:21 242:15
device's 86:2	73:25 74:1,1	154:22 159:1,5	247:4,11
86:10	74:17 77:16	216:17 248:10	250:23 251:3,9
devices 13:19	78:9 80:6	249:15 272:21	251:12,16,17
17:2 32:4 36:2	90:18 91:14	difficulty 138:1	255:20 274:19
40:14,15,17	94:23,24 97:17	dig 169:20	277:3 278:12
66:4 67:18	98:5 100:7	digested 139:23	284:2,7 295:14
70:13 111:23	103:12 113:25	digital 247:19	295:25
117:22 118:10	118:2 121:2,13	diligently 260:3	discloses 244:2
123:7 126:14	135:3,18 142:4	dimmer 99:3	disclosing
156:17 157:4	142:6,8,9,14,18	direct 59:6,10	237:17 240:18
157:10 158:24	142:22,25	59:14 101:18	240:21
159:9 160:16	144:20 146:9	162:20 164:8	disclosure
160:20,21	157:19,20,20	228:6	24:14 25:5,19
162:13,15	158:16 159:18		25:20,23 27:4

[disclosure - documents]

29:10,13,17,24 30:14,23 31:1 31:5 35:15 62:10,11,13,17 64:10 183:13 185:5 196:16 197:18,19,21 198:14 200:2 223:3 231:24 233:23 236:24 237:14,19 238:1 241:12 241:18 242:19 243:5,16 250:24 251:4,7 251:12 256:3,6 256:18 257:4 disclosures 3:18 24:2,7,17 24:18 26:1,3 30:1 182:21 198:4,19,23 199:3 257:17 257:22 discover 239:11,12 discovered 67:6 69:7 discuss 52:9 111:8 255:25 discussed 43:5 94:25 96:19 122:6,18 140:11 165:20 166:3,7,21	225:13 231:23 233:2 247:24 278:4 294:1 295:22 discussing 71:20 95:2,8 214:7 216:18 233:5 238:3 274:24 discussion 232:1 display 3:11,16 9:7 12:25 21:10 33:13,16 34:4,12 40:6 44:6,8 48:15 48:16 49:11,13 50:5,16 51:21 65:22 66:2,5 67:9 68:3 79:11,23 90:21 91:24 99:4 108:6 109:3 112:2 113:12 114:9 115:3,6 115:7,9,13,24 115:24 128:1 140:20 141:20 141:22 148:9 159:9 186:16 215:14 225:10 235:11 259:19 268:19 269:2,5 270:7 271:23 282:10 283:8	291:5 294:12 display's 108:5 displays 1:4 4:19 8:7,18,22 8:25 11:24 12:8 19:17 22:21 31:19 33:3,22,25 34:8 45:10 48:5,5,8,13,19 48:19,22 49:17 50:2,17,23 51:18 52:1 68:24 81:10 83:4 86:19 90:22,23 92:12 95:11,13 96:21 97:5 99:15 105:5 114:2,18 115:19 123:3 126:16 128:25 140:16,18,21 143:1 174:20 206:13 220:11 220:18 221:7 222:6 225:7,9 254:5,10,15 260:7 267:3,7 269:19 299:4 dissolve 204:6 distinct 172:14 172:15 distinction 142:15	district 1:1,2 4:22,22 57:3 diverse 67:1 128:15 division 1:3 4:23 doctor 32:13 52:16 57:17 111:16 112:15 134:20 163:11 208:4 222:20 231:22 document 3:16 72:20 93:5 100:17 102:15 104:14 105:24 106:19 107:3 116:10 147:19 147:22 148:10 148:15 182:17 183:4 185:14 185:19 232:24 234:6 documentation 212:5 245:5 documents 79:23 80:2,8 80:12,16,23,25 81:1,3,4,9,22 83:6,10 90:10 96:15 122:14 122:16,19 147:17 163:21 164:19 165:2,4 165:11 232:14
--	---	---	--

[documents - earlier]

292:12,16 293:2,8,13,14 doe 13:10 14:4 14:7 15:3 46:18 47:11,13 47:20,22 48:11 48:14,24 50:18 50:21 51:4,13 51:19 112:21 112:23 113:2,5 114:23 115:15 116:15,25 117:10,12 118:20 119:12 doing 11:11,12 16:19 20:19 21:15 32:8 35:5 36:12 39:15,20 44:5 44:5,7 63:25 81:20 90:11 92:11 98:23 126:5 133:20 140:11,16 145:1 147:4 149:25 150:1 152:17 154:19 173:24 174:5 198:14 219:24 220:21 225:25 226:1,3,9,20 233:16 238:12 239:21 240:2,9 243:9 247:25 250:2 276:3	277:16 281:23 282:2,4 286:25 dollar 112:17 domain 20:11 dome 131:19 donor 176:9 doosoo 281:25 dopants 77:17 168:18 181:23 dope 77:3 dose 287:15 dot 68:17 73:2 74:13 143:11 148:2 266:17 285:7,19 dots 67:21,22 67:24 68:13,15 69:5,6,9 72:23 73:5,9 89:15 92:14 93:16 96:11 255:14 255:16,17 265:25 266:4 266:25 267:1,2 267:6,10 285:12 286:7 doubt 250:22 251:2 downstream 288:2 dr 32:12,16 63:12,24 71:16 71:23,25 73:1 73:8 132:13 139:4,5,5,6,9	139:10 176:18 187:1,10 188:3 188:7,7,24 189:12 191:2 199:15,19,23 199:23 201:10 201:11,16 203:1,1,7 206:9 207:3 208:5 218:1 222:21 224:2 233:6 234:13 236:16,24 237:14,15 238:10,11 240:16,23 243:3,23 244:12,15 245:17 246:1 246:24 247:12 249:8 250:19 250:23 251:3 253:17 255:6 255:21 257:8 257:12 285:6 285:16,21 draft 26:6,13 26:23 27:12 164:14 drafted 26:12 28:4 dram 214:15 draw 124:11 drawn 187:9	driver 173:5 drivers 119:10 driving 115:17 drop 159:14 204:22 droplet 45:19 205:7 droplets 144:12 145:12 dropping 107:25 drs 138:23 dry 37:25 159:15 dual 50:21 51:14 85:9 87:23 due 159:13 169:22 duly 297:6,14 dunk 218:13 dupont 35:7 59:24 60:1,1 259:6,20 262:5
e			
e 3:1,5 299:9,12 300:1 earlier 43:5 55:8 59:2 96:5 117:1 121:14 141:18,18 154:16 162:6,7 225:13 232:9 290:1 291:4 293:4 295:10			

[early - emagin]

early 12:19 21:22 38:25 41:6 42:1 99:11 143:4 176:21 221:3,9 221:9 258:14 289:1 ease 138:1 easier 12:23 76:25 267:25 279:8 easiest 206:11 easily 85:3 156:12 eastern 1:2 4:22 57:3 easy 53:13 210:10 272:22 eco2 105:21 106:6,13,20 107:4,15,20,21 108:15 110:17 economical 237:25 edge 154:16 effective 150:5 180:15 effectively 49:25 108:3 274:25 effects 44:2 108:4 efficiencies 160:24	efficiency 17:3 50:24 51:4 81:18 87:5 108:10 114:6 120:4 123:7 124:5 160:22 160:22,23 161:2,3,4,8,9 161:16,17,18 161:19,24 162:2,3,13,14 162:21,21 170:11,13,19 293:20 efficient 181:18 217:4 effort 44:20 50:21 215:6 221:18 222:2 efforts 20:13 45:6 222:16 either 24:5 25:17 37:9 61:5 98:2 99:1 119:5 127:17 127:17 185:13 212:2 226:15 238:10 254:10 289:5 elaborate 50:3 electrical 99:2 161:11 170:24 171:2 205:3,5 205:11 207:5 207:15 288:21	electrically 170:2 171:23 179:21 209:25 electrodes 171:21 electrolumin... 161:4 electron 38:4 74:23 75:13,23 76:14,17,20,22 77:8 84:20,20 85:11,20 119:2 168:12 171:7 174:21 175:2,3 175:17 176:1,9 176:12,13 178:2,22 180:1 180:3,10,16,22 181:1,10,15,19 271:3,14 289:24 290:22 291:19 292:1 electronegati... 289:4 electronic 76:4 76:22 77:4 electronically 289:21 electronics 1:7 1:8 4:20 16:9 115:17 267:5 288:1 299:4 electrons 37:21 75:21 76:24,24 83:12 161:12	173:7 181:16 182:4 291:1 electropositiv... 289:4 element 256:11 256:11,23,23 256:25 257:2,2 277:17,17,18 277:18 elevated 40:21 158:3 else's 187:11 192:21 240:17 243:3 251:22 259:23 emagin 201:17 201:18 211:19 211:20 212:17 214:4 215:5 225:24,25 226:8 229:16 233:11,22 235:14 236:13 236:17,21 237:5,7 238:11 238:21 239:4 239:11 240:13 241:17 242:1,4 242:6,9,21 244:8 247:6 250:18 255:20 256:9,21 257:13 265:12 275:14 279:25 280:9,10
--	--	--	--

[emagin - engineers]

286:14 email 134:6 199:18,22 200:1,6 201:1 201:16 206:16 208:5 240:20 emails 238:17 emanuel 2:13 5:14 6:15 emerging 3:11 emission 17:3 50:23 74:24 75:5,8,14,18,19 75:24 76:2,4,7 77:6 84:20 94:17 171:7 177:21 178:4,6 179:10 268:20 273:8 291:20 emit 13:19 98:14 118:10 emits 286:12 emitted 290:2 emitter 170:12 emitters 113:23 118:24 270:17 285:11 emitting 11:16 13:6,24 34:25 48:21 49:7 51:2 84:13 94:18 118:24 emphasize 248:17	employed 8:25 employment 9:10,13 enable 34:9 79:17 174:20 264:1 enabled 81:10 169:21 226:18 266:15,19 294:21 enabling 123:2 126:8 encapsulate 19:18 166:10 222:14 encapsulating 172:22 212:23 encapsulation 16:20 32:2,4 32:10,16,21 33:1,5,6,7,8,12 33:15,17,20 34:1 38:16 39:3,5,6,16,21 39:22 40:25 42:8,9,14,16 43:3 106:12,21 126:22 127:11 127:13,21,23 128:2,8 129:2 129:3,10 130:15,20,21 131:12,21 135:15,20 142:21 149:10	166:9 172:2 173:13 174:16 200:18,20,21 201:2 210:3 211:7,13,17,21 211:24 213:1 213:24 217:13 217:24 218:2,6 218:6,10,12,14 219:4,9,15,23 219:24 220:4,9 220:17,24 221:22 222:2,9 222:13 223:1,8 223:19,24 225:6,15,17 226:3,6,6,19,23 229:17 233:2 233:16 235:13 235:15 236:10 237:8 238:5,22 238:25 239:10 239:14,15,17 239:25 247:17 248:21 253:5,9 260:4 275:4,20 276:5,7 277:25 278:7 279:25 281:11,21,24 283:10 286:18 286:19,21 encapsulations 282:17 286:16 enclose 131:15 131:19	enclosed 41:14 encourage 24:2 encouraged 257:16 ended 112:23 113:2 141:16 energetic 290:22 energetically 181:14 energy 13:2,11 13:13 44:25 45:3 46:8 75:22,23 108:19 112:18 113:5,5,9 117:13 141:10 161:10,11,15 181:14 219:5 enforceable 69:11 engaged 9:12 10:23 58:25 engagement 283:5 engineer 21:7 31:22,23,24 32:3 151:9 249:21 273:11 engineering 53:9 119:4,5 engineers 22:20 31:25 138:11 257:17 257:21 258:4
---	---	--	---

[engineers - example]

292:24 engines 142:18 english 147:24 150:15 enhanced 276:21 enhancement 109:7 enrich 258:2 entered 195:23 enterprise 12:4 269:10 entire 204:24 215:20 envelope 145:23 146:4 174:16 environment 40:7,9 41:14 83:19 151:21 154:20,24 environmental 160:8 environments 84:22 envy 270:4 eqe 170:13 equation 159:5 equations 158:22 equipment 138:2 errata 299:14 299:16 300:3,5	esoteric 36:24 especially 37:24 283:10 esq 2:8,14 299:1 essence 53:2 essentially 10:10 establish 46:16 established 295:7 et 4:20,21 19:18 24:10 27:23 69:5 105:12 208:21 253:15 299:4 etching 173:23 207:23 214:18 214:24 etl 85:22 ev 3:10 evaluate 25:22 46:1 51:25 198:2 223:22 248:22 evaluating 240:3 evaluation 223:1 evaporation 130:18 131:7 133:17 135:13 136:4 137:1,11 137:24 146:18 149:14 150:4	150:20 152:6 152:22 174:12 evaporative 172:2,21 175:5 evening 296:11 event 188:10 events 58:2 eventually 12:20 37:25 97:5 144:19 147:10 278:10 everybody 28:25 36:18 66:7 117:24 143:22 200:20 211:1,22 214:6 233:18 273:15 291:12 everybody's 226:20 evidence 87:3 92:18 242:14 243:2 274:4 295:21 evolution 166:7 evolved 279:8 292:19 evolving 286:5 exact 6:21 8:1 9:8 14:8 34:6 54:9 77:25 88:9 98:7,16 109:6 141:9 234:17,20 242:24 270:10	270:20 exactly 6:16,18 15:7 22:16 23:2 25:1,11 40:18 42:5 47:14 54:8,9 56:20 58:7 84:24 87:15,25 93:25 97:19 103:23 123:10 130:13 141:17 144:14,25 164:5 176:23 201:12 234:23 235:3,3 245:4 251:8 252:15 268:9 278:11 278:20 280:18 281:4 examination 3:3 6:5 examine 24:17 26:2 53:11,13 75:1 179:2 284:18 examined 6:2 297:13 examiner 62:21 65:2 examining 284:10,11 example 20:15 36:14 37:12 38:4 63:5 64:25 67:3
---	---	--	---

[example - fact]

72:22 73:2,10 75:19 83:9 84:4,12 86:3 86:11 103:17 123:5 124:9,10 126:4 127:4 135:9 158:13 166:8 170:17 170:19 205:2 205:10 216:20 217:2 267:19 273:7 examples 26:10 26:17 27:22 44:15 284:1,11 except 100:1 excerpted 101:15 exchange 199:22 201:2 excited 65:1 exclusively 48:4,7,11 executed 38:14 285:24 executive 9:23 executives 9:19 exercising 235:15 exfoliate 174:2 exhibit 3:7,8,9 3:10,11,13,14 3:16,18 70:23 70:24 71:1,6,8 71:9,10,11	78:10,11,14,15 100:10,12,13 100:18,20,21 104:10,13,14 116:4,5,8,10,17 131:25 132:1,4 132:7 148:4,6 148:7,9 182:7 182:8,11,20,22 227:23 228:15 228:16,17 exhibits 147:14 existing 97:10 exists 294:5 expand 48:14 expensive 51:9 experience 30:7 30:8 59:5,7,7 59:10,14 89:15 91:12,13 128:15 137:3,4 177:9 216:24 216:25 248:11 253:18 254:5,9 254:11,14 262:2 265:10 268:10 288:7 289:1 experienced 222:24 expert 21:7 22:7,10,15 54:4 57:10 58:23 60:20 61:10 70:1	77:23 78:7,15 138:16 139:8 139:22,25 140:5,8 150:21 150:25 151:1,8 151:14,17 152:3 287:8,16 287:21,22,24 288:4 289:16 290:4,6,8,14 291:5,7 292:6 292:8,10,11 295:4 expert's 163:15 expertise 22:2 22:19 79:15 151:11 289:25 291:3 experts 24:20 96:24 138:18 211:16 explain 113:19 127:1 explains 196:24 explore 48:20 272:21 explored 113:11 274:5 expose 156:10 exposed 100:4 express 62:2 65:9 extent 55:16 external 45:16 160:23 162:20	170:13 extra 204:3 210:18 212:14 extremely 88:22 294:9 f f 101:19 102:5 102:8,14 fabricated 174:17 fabricating 222:17,21 fabrication 19:12,13 33:13 33:16 34:14 118:14 167:17 169:10 172:17 172:17 179:12 287:25 fabrications 169:6 fabricator 157:9 facilitate 87:17 176:1 288:22 291:17,18 facilitates 76:19 facilitating 291:19 facility 14:19 fact 6:25 18:12 22:3 49:4,19 50:11 66:10 92:22 140:7,10
---	--	---	---

[fact - film]

142:9 158:17 165:12 166:9 181:18 213:11 230:10 248:20 253:12 270:6 275:13 277:10 277:24 278:19 279:6 287:8,15 factor 93:18 278:5 factors 86:18 factory 11:9 95:15 facts 55:23 56:14 264:3 fail 158:13 fair 124:1 254:12 287:10 familiar 7:4,20 20:9 36:23 38:10 39:4 52:19 61:13,17 63:13 64:21 69:25 70:12,16 76:15 86:13 104:20 215:3 284:15,21 familiarize 183:4 family 72:4 far 30:19 38:6 38:9 47:6,7 50:10 91:4,20 92:23 137:22 246:14 280:20	281:8 fashion 79:9 278:18 fast 136:7 faster 85:23 87:17 135:12 136:3,9,10 226:9 fc26-04nt419 116:13 fc26-04nt419... 116:22 feasibility 48:2 51:20 feasible 202:9 features 293:19 february 199:19,24 221:1 fed 201:17 212:17,18 226:1 233:11 235:14 236:21 238:11 240:6 240:13 241:1 federal 300:1,8 300:9 feedback 26:14 28:5 feeds 173:6 feel 72:11 105:24 183:3 feelings 262:12 fewer 279:5	field 12:2 18:3 18:4 23:19 53:7 59:1,8,17 59:18,19 60:4 60:9 63:9,13 74:15,23 75:13 109:2,3,3 140:1 150:22 175:12 224:13 258:1 282:14 284:14 fields 62:3 76:12 figure 43:12 101:25 120:7 120:17 124:20 124:21,22 147:10 223:4 275:2 figures 135:22 165:5 188:19 188:19 file 23:18 24:2 100:22 249:3 252:5,14,16 257:17,22 258:18 filed 4:21 24:25 27:15 28:8 72:5,8 196:4 198:19,22 199:3 239:4,10 241:2 242:3,4 242:6,22 243:4 243:9 251:7	252:13 274:13 files 274:6 filing 23:20,23 24:9,15 25:14 25:17,24 197:5 197:9 198:9 245:11 246:21 filings 41:22 198:18,20 253:2 286:3 film 33:1,7,8,12 33:15,17,19 38:16 39:3,5 39:16,20,22 40:25 42:7,9 42:16 43:3 106:12,20 109:11,18,19 109:25 110:1 110:19 126:22 127:13,21,23 128:2,8 129:9 130:19,20 131:21 135:13 135:15 137:16 149:10 166:8 173:13 200:18 200:19,21 201:2 210:3 211:6,13,17,20 211:24 213:1 213:24 217:12 217:23 218:14 218:22 219:4,9 219:22,24
---	--	---	---

[film - fold]

220:9,23 222:8	183:6 215:21	82:8 104:17	flexible 16:21
223:8,19,23	220:3 237:21	112:4 114:14	33:9,13,16,18
225:6,14,16	241:13 252:25	133:4 140:25	33:24,25 34:3
226:3,6,11,19	fine 87:8,12,21	143:1,10,21	34:9,11,16
226:23 229:17	87:22 88:3,11	146:16 149:24	42:11 126:15
233:2,16	88:24 89:12,17	164:14 168:2	174:2,20 220:9
235:13,15	90:13 91:4	169:25 171:12	221:7 224:24
236:10 237:8	92:7,9,19,25	171:13 175:25	225:1,2,3,8,12
238:5,25	93:2,14,19	183:2 199:17	230:3,19
239:10,14,15	94:5,20 95:2	200:22 201:6,7	flexo 230:12,12
239:17,25	95:15,23 96:16	204:9 213:23	230:16
247:16 248:21	96:22 97:4,9	221:20 234:25	floating 245:3
275:4,20 276:4	97:22,24 98:13	235:23 236:19	flow 154:21
276:6 277:25	98:20 99:16	241:4 245:1	168:17
278:7 279:24	103:11,12,18	252:14,15	focus 11:23
281:11,21,23	127:7,9,10	260:5,9,16,20	12:7,13 13:18
282:13,16	133:12 134:25	268:15 270:22	15:15,16 42:8
283:10 286:16	140:20 143:5	294:14	44:14 53:10,21
286:18,18,21	143:10,19,22	five 10:16	135:19 136:1
films 110:12	148:25 165:16	21:19 28:19	148:20 164:18
filter 92:13	166:15,17	54:8 198:25	164:22 165:1
102:8,18,23	200:16 230:2	fixed 232:16	165:10 220:21
106:11,20	294:8,22,25	flag 237:2	221:11
108:16 110:9	295:4,8,13,22	flash 130:18	focused 12:3
110:17	finish 8:9 92:2	131:6 133:17	42:12,24,25
filters 67:15	241:4 280:3	135:13 136:4,7	59:20 115:16
103:2 108:2	firmware 288:2	136:9 137:1,11	218:11
110:15	first 2:14 6:13	137:24 146:17	focuses 79:9
final 3:13 26:19	6:24 9:4,6	147:8 149:13	focusing 11:15
86:2 90:23	10:13,25 18:10	150:3,20 152:6	53:18 121:13
116:11,18,25	18:13 22:3	152:21	216:4 241:13
financially 5:5	28:21 31:5	flex 16:21	fold 105:12,12
find 55:23 58:5	44:4 54:18,19	flexibility	105:16,16,16
63:6,15 66:8	58:20 71:25	169:17	105:20 106:7
88:8 140:7	76:21 81:24		106:16,16,20

[fold - gamut]

107:13,13 follow 29:21 followed 209:13 229:13 follows 6:2 299:8 force 102:12,13 102:15 forced 264:5,6 forecast 3:12 forget 57:3 forgive 274:13 forgot 215:4 forgotten 233:12 form 37:13 45:18 167:8,22 177:15,15 208:6 formal 232:17 format 34:9 formation 45:19 151:21 152:23 formed 152:21 forming 126:21 135:13 151:8 151:14 forms 136:11 177:13 formulation 40:5 151:12 forrest 133:1 forth 140:6 193:8	forthcoming 95:10,12 forward 26:5 27:3 99:7 128:19 134:5 140:18 258:5 forwarded 134:10 found 126:13 128:3 264:24 founder 132:20 founders 132:16 four 28:21 54:8 54:14 55:4 118:6 119:9 125:15 frame 129:17 frames 119:11 frank 17:17,18 franky 118:16 frcp 300:1 free 72:11 105:24 183:3 207:5,15 208:21 209:23 210:7 216:5,10 227:8 236:5 238:13 260:24 267:9 freedom 49:19 259:4,7 261:18 freeing 211:15 237:23	frequently 220:20 friend 249:17 frischknecht 31:12,13 188:4 188:7 199:19 199:23 203:1 206:9 207:3 214:21 215:3 218:1 237:15 238:10 front 67:15 77:11 110:3 ftir 150:9 full 12:24 13:3 13:4,4,7 48:15 48:25 50:4,5 51:17,21 68:25 84:15 92:11 104:4,5,6,9 113:12 114:1,9 114:18 115:6 123:13 142:16 142:17 220:10 220:10,11 223:2,3 fully 45:24 82:2 107:8 150:9 152:1 function 37:18 61:25 75:1,1 77:25 180:15 functionally 118:3	functions 288:22 289:17 290:25 fund 47:23 fundamental 12:18 65:20 145:6,18 267:1 funding 14:6 46:24 117:14 229:4 funds 14:4 furnished 236:1 further 20:4 168:9 190:7 221:3 274:5 297:20 furthermore 67:20
			g
			gains 270:6 galaxy 105:12 105:12,16,16 105:16 106:7 106:16 107:13 107:13 game 144:6 gamut 13:4 81:17 87:5,7 87:10,19 88:12 88:16,19 90:12 93:6,16 95:7 97:24 98:5,11 99:8,23 107:4 107:13,16,19

[gamut - go]

108:10,13,17 108:23 109:7 114:10 120:3 123:13 124:6 144:18 293:20 293:23 294:12 gamuts 93:17 gap 54:10 ge 227:2 255:12 gen 85:4 95:15 general 7:2,3 7:10,11,12 18:2,5 29:19 33:11 51:10 65:15 69:25 87:24 134:23 135:7,11 136:21 141:13 150:22 156:21 171:8 174:24 174:24 179:1 180:11 181:7 197:24 227:3 232:13 262:2 268:6 271:6,7 284:13 generalities 7:17 generalize 162:5 255:4 generally 8:2 64:1 generate 49:2 104:9 137:7 173:7 226:14	generated 63:16 164:16 185:20 generates 127:24 generating 49:8 255:9 generation 65:24 224:25 226:15 278:8 generic 74:21 75:11 gentleman 20:22 31:12 genuinely 251:18 geometrical 224:23 german 36:5 121:5 germany 14:20 15:10,18 16:1 16:4 17:12 20:4 112:25 121:5,17 176:22 getting 55:22 give 8:11 10:6 11:3 26:14 27:14 47:11 92:6 120:21 122:9 138:4,16 147:5 149:17 154:12 161:16 164:7 165:16	199:11 204:6 228:18 241:4 267:21 289:7 given 69:9 80:15,20 81:2 147:18 161:15 165:9 292:13 292:16 gives 113:24 giving 36:9 glance 143:10 149:24 glass 16:8,13 16:18,21 19:17 32:2,2 33:21 34:14,14 118:15 168:2 174:2 206:13 218:5,5,6,6,14 218:14,15,15 218:18,18,22 218:22,23,23 218:24,24 219:4,4,6,6,7,7 219:7,7,14,14 219:21,21 220:4,4 221:22 221:22 222:1,1 222:12,12 224:7 225:3,4 225:14,14 260:4,4 glassy 177:8,18 179:16	glue 146:6 go 4:15 8:14 16:19 18:17 26:4 27:3,19 33:24 50:8 52:14 59:19 60:5 61:7 66:16 70:2,10 72:9 94:12 101:2 105:8 109:11 110:24 112:8 113:17 114:12 117:25 119:17 126:10 126:17,17,18 126:18 131:1 132:12 133:13 134:2,12 148:17 149:8 149:12 163:4 165:19 181:12 182:24 183:19 184:18 185:17 190:2 193:4 194:22 195:20 198:7 199:21 208:24 217:7,7 222:7 224:14 227:24 230:16 233:22 239:6 241:5,23 256:16 262:23 263:24 267:22 268:11 289:7
---	---	--	---

[goes - head]

goes 50:1 83:24 136:8 262:21 266:22 going 24:8 47:1 52:2 53:23 56:1 99:4,5 106:17 129:21 133:24 162:25 193:8 197:14 209:18 238:6 262:7 289:9 gold 37:13,13 good 4:5 5:20 6:7 10:20 11:21 29:19 30:6 31:19 82:14 84:12 99:22 119:2 137:21 140:19 142:24 163:23 179:11,12 231:13 249:20 249:21,25 250:6 255:3 270:21 287:14 government 46:24,25 graduate 236:20 grail 224:13 grant 112:18 117:10 grants 46:18 graph 147:24 147:25 256:17	graphs 151:4 293:25 294:1 great 64:20,21 84:9 89:1 114:16 116:1 120:16 134:4,9 135:9 146:4 249:11 greater 199:17 234:2 green 13:24 45:10,11 49:3 49:24 50:24 67:12,24 84:13 87:9 88:20 89:15 93:11,22 94:5,6 98:8 99:20 113:13 119:14 125:15 125:21 142:2,4 144:16 168:24 270:15,22 grid 190:25 gritty 117:21 group 17:9,17 31:21 35:13 36:6 48:9 118:4 121:5,14 225:18,19,22 groups 17:15 36:24 guess 62:2 121:17 150:13 160:5 185:19 261:14	guest 76:2,3,5 77:2,2,17 guests 77:14 guide 136:22 gupta 118:12 guy 31:19 192:3 233:13 244:2 250:6 guys 156:25 183:6 211:16 212:18 217:16 223:21 235:14 254:19 <hr/> h <hr/> h 3:5 half 14:5 163:1 234:25,25 hand 83:14,15 85:1 92:9 102:1 109:20 124:19,25 125:13 135:21 135:24 186:23 188:22 192:23 193:1,2 194:5 194:14 195:3,5 215:15 298:2 handheld 90:22 handled 299:8 hands 10:17 59:6,9 61:20 81:11 216:25 219:8,8 handwriting 189:13,20	191:3,15 handwritten 188:17,18 hany 139:1,2 happen 47:9 56:1,2,3 222:9 happened 6:17 79:16 121:10 196:16 241:17 245:5 258:3 260:17 happening 61:21 84:24 174:25 216:22 217:9 219:20 224:14 246:12 248:22 happens 180:19 hard 37:21 51:16 65:3 78:20 115:20 115:25 125:7 143:8 171:3 198:20 205:22 292:2 harder 99:13 115:24 head 10:2 15:19 45:25 46:1 138:8 140:4 143:16 153:25 178:6 248:12 255:23
--	--	--	--

[heading - huge]

heading 228:5	160:9 161:16	hmm 101:2	6:9 129:24
headquarters 112:25	170:19 255:2	106:4 194:18	183:21 287:17
hear 163:22	257:4 266:25	208:2 210:13	296:14 297:10
250:25 270:11	269:19 270:8	254:7	299:5
heard 4:12	294:12	hoc 25:16	honest 244:2
10:14 152:2	higher 50:22,25	hold 8:9 20:7	244:15,16
283:3,4	90:22 91:24	32:6 38:20	hong 2:8 299:1
hearing 44:13	93:7 114:5	56:25 88:6	hope 288:18
heat 151:25	156:24 157:5	89:20 91:25	hoping 114:5
159:15	159:10 161:17	105:22 126:24	223:14
held 2:2 265:24	161:18,19	149:6 165:14	horizontal
help 7:2,10	162:1,3 170:13	200:3 208:22	215:16
22:6 31:18	170:14,21	208:22 212:13	host 76:3,8
33:12,16 71:4	175:10 178:22	215:1 216:2	77:2,14
92:1 180:9	291:13	224:11 241:3	hour 52:3
181:9 220:14	highlight 62:18	241:21 280:2	163:1
helped 223:1	103:22	hole 74:25	hours 125:20
helping 108:13	highlighted	75:15,23 76:13	125:21 156:13
helps 181:19	123:1 139:24	76:16 84:19	158:12 164:6,9
hereunto 298:1	highlighting	85:11 168:12	287:3,12 296:5
heterogeneous	105:20	171:7 174:21	house 18:25
167:18	highlights	176:7 177:7	19:5,20 20:14
hewlett 10:11	118:19,23	178:7 289:12	26:5
21:18 289:2	highly 1:14	289:19,19	hp 10:16,18
high 7:16,19	129:23	291:18,25	21:4,5 31:17
11:23 22:2	hire 254:9	holes 75:21	31:18,20 39:24
33:25 52:18	hired 9:24 21:8	83:12 161:12	229:3 240:5
84:16 90:24	21:24 22:1	171:22 173:7	hplc 150:7
92:8 93:4	23:3 31:15,18	290:19 291:1	htl 176:7
96:21,21,21	31:19	holistically	hue 113:25
97:5 99:15	hires 30:9	173:18	hues 49:4
117:18 140:21	historically	holy 224:13	huge 108:7
158:8,18,19	38:23	home 139:25	109:9 134:15
159:13,16	hit 144:7,13	homer 1:16 2:1	292:2
	288:19	3:2 4:17 5:24	

[humidity - increased]

humidity 156:12,25 158:6,19 160:10	ideas 200:19 219:10 236:7 237:22 240:25 243:13 245:7	174:7 220:13 226:12 257:21 258:7,9,14,17 258:24 261:10	152:13 153:3 153:13 156:5 169:9,11,11,22 170:4,7 181:20
hundred 169:14	252:6 253:21 255:21 284:7	262:12 264:15 264:19 269:9	217:19 294:16
hurry 24:16 191:6 232:19	iec 160:6,18	269:11 272:2,4 272:12 278:4	improvements 217:17,18
hydrogen 124:16,25	ieee 159:19 160:5	294:9	improving 17:2 44:2 84:4 86:2 108:17 180:9
hypothesis 263:7	image 101:15 162:10,10	impossible 96:25 97:3	inaccuracies 27:23
hypothetical 263:4	imagine 34:7 85:22 87:16,24 144:5 177:10	impressed 79:16 125:3 295:5	inactivity 55:1
hzhong 2:10 299:2	178:9 221:22 227:21 230:11 286:17	impression 61:9 65:15 88:15	incentivize 258:4
i			inch 143:11 202:5 294:22
i.e. 202:2 ic 16:21 ics 226:7 idea 13:17 24:3 30:6 38:13 46:25 63:2,16 65:20 107:18 131:14 190:19 195:13 209:23 210:4 213:3 214:23 220:2 224:6 237:15 239:6 240:17 242:15 243:3 243:15 247:15 251:12,14,22 251:23 274:21 276:2	imbalance 171:11 impact 126:19 impermeable 43:17,18 implemented 252:16 importance 24:19,20 important 11:14 28:20 63:9 88:22 93:16 95:5 97:19 99:8 103:5 123:2 124:14 125:2 126:15 154:14 154:15 167:16	improve 108:10 124:16 128:3 170:10 176:13 180:16 180:22 improved 90:13 123:6,23 124:18 125:10 125:14 126:6,7 278:6,21 improvement 81:22 82:20 84:2,3 95:7 97:21,23 122:5 122:23 123:15 124:5,5,6,13 125:5,9 126:1 150:19 152:5	include 16:1 69:4 included 13:21 165:5,6 299:14 300:3 includes 16:8 41:1 79:14 113:22 including 33:7 42:10 286:13 incompatible 142:11 incomplete 263:3 increase 86:1 87:4 291:9 increased 85:8 86:10 123:8

[increased - inorganic]

269:24	inference 130:9	injecting 291:1	149:14 150:4,5
increasing	information	291:1	150:19 152:5
85:14	18:22 27:20	injection 74:23	152:13,16,18
independent	49:16 54:16	75:13 76:14	152:22 153:3,9
78:9 79:9	55:18,19 79:12	176:1,13	153:14,20
83:16 84:3	85:18 90:7	180:16 181:10	154:9,21
165:23 167:3,6	91:8 93:11,25	181:19 289:19	207:19 216:21
167:11,23	94:2 95:17	ink 131:16	220:10,24
168:1 172:3,11	100:5 103:14	154:21 230:15	223:5 229:6
172:13 279:2	103:20 104:1	inkjet 3:14 13:5	247:8,14,20
independently	105:2 107:8	13:8,25 36:21	248:2,4 252:1
168:8 251:13	122:10 123:22	37:24 38:7	252:19,23,25
indicate 203:6	130:6 147:22	41:17 44:22	253:9 274:16
indirectly 59:8	150:23 164:17	45:1,3,7,14	276:10 279:21
59:24 60:9,13	164:25 165:8	46:2 50:11,15	279:23 280:11
87:21 169:7	178:5 238:16	50:19 51:17	280:20 281:1,8
indium 267:12	241:8 244:5	52:1 84:12,23	281:16,20
individual	245:3 259:17	89:16 90:3	282:3 283:16
10:17 222:25	266:8 271:25	92:15 93:18	294:23 295:3
industrial	283:14 292:20	96:12 99:12,14	inks 45:10,11
91:12,13 92:23	295:25	99:16 113:13	45:18,21
industry 33:20	infrastructure	114:14 115:21	innovate 215:6
34:3,8 41:7	35:4 48:18	118:13 128:10	237:21
67:21 68:14	infringe 264:25	129:6,10 130:4	innovation
76:11,16 79:20	infringement	130:10,12,18	61:11 108:8
84:14 85:13	61:1 77:22,24	130:23 131:2,6	110:12
88:15 91:17	122:1 273:19	132:8 133:5,16	innovations
110:10 159:21	273:20	135:7,9,12,16	79:10
212:21 221:24	initial 125:12	136:2,15,16,19	inorganic 39:6
225:8 248:23	125:14 181:9	137:1,4,6,11	40:1,20,21,23
inert 151:21,21	260:23	138:7 141:1,11	43:9,16 51:8
154:20 202:3	inject 37:20	141:23 142:1,8	127:16 131:10
infer 130:5	161:6,12	142:20,22	131:11,16,17
142:19 246:5	181:16	143:3,5,12,15	131:18,18
		143:25 145:10	145:8,17,20,21

[inorganic - invention]

145:22 146:5 146:13 155:7,8 155:13 210:15 212:22 215:22 216:6 226:24 229:11 236:6 275:20,24 276:14,17 278:1,17 279:2 282:1,2,14 inorganics 214:13 216:11 input 26:9 247:18 instance 45:9 66:1 81:24 156:10,25 170:10 221:20 225:23 229:16 233:8 290:18 294:23 instant 130:20 instruct 53:24 integrated 173:18 integration 19:21 intellectual 259:23 260:11 261:9,23 264:17 272:5 272:13,18,25 273:1,3,23 intended 82:13 120:18	intentionally 200:14 244:22 246:15 interaction 77:4,7 235:18 interactions 244:19 interchangea... 76:11 interconnecti... 171:2 interest 261:1 interested 5:5 51:5 240:8 262:22 297:22 interesting 127:22,25 182:13,13 195:7 225:16 239:6 264:12 interests 35:23 interfaces 289:20 interlinked 84:17,18 170:18 internal 199:18 266:13 internally 245:20 international 1:4 4:19 160:6 299:4 internet 4:11	interns 254:18 internship 21:4 21:15,17 interpret 70:6 interpretation 203:13 interpreting 128:17 interrelated 172:20 interrelation 171:1 interrelations 170:24 interrupting 39:10 interruption 101:23 intervals 26:2 intractable 204:5,7 intricate 166:17 169:6 introduce 5:18 37:18 41:2 178:12 181:23 213:9 220:14 253:13 261:16 291:15 introduced 22:3 71:7 106:25 108:19 introducing 174:6 179:4,5 182:2 220:15	261:16 introduction 112:4 invalid 60:18 257:9 invalidate 277:23 invalidity 62:5 121:22 invented 63:1 250:18 267:4 invention 3:18 24:2,7,14,18 25:5,19,20,22 26:1,2 27:4 28:1 29:10,13 29:17,23 30:1 30:14,17,19,23 31:4,9,9 35:15 62:9,10,13,16 64:9,21 182:21 183:13 184:23 185:5 196:16 196:21 197:10 197:17,19,20 198:4,14,19,23 199:2,16 200:2 231:23 234:2 235:5 236:23 236:25 237:13 238:1 241:18 242:16 243:4 243:15 245:18 249:2 250:19 250:24 251:4
---	--	---	--

[invention - kateeva's]

251:12 256:5 257:17,22 inventions 258:4 inventor 21:11 26:9,21 27:5 27:14 29:11 31:8 62:12 71:25 196:24 196:24 inventors 10:15 26:10,13 28:4 28:7 30:7 41:24 250:12 257:12 invest 229:2 invested 113:3 investigate 126:19 investigated 113:9 investigation 114:14 investment 15:2 265:21 investor 265:16 investors 229:2 265:19 involve 55:19 involved 9:7 60:7 81:9 185:9 222:21 involves 53:25 ionization 289:13 290:23	ip 35:16 43:15 225:24 258:2,7 258:22 259:5 262:11,15,17 264:21 265:7 266:19 267:1 267:13 273:13 273:14,16 iphones 270:8 ipr 182:22 ipr2024-01222 3:18 ips 258:10,25 irell 2:8 5:12 irell.com 2:10 299:2 iridium 273:7 irrelevant 140:8,22 168:18 isolated 84:25 87:14 isolates 173:15 isolation 179:3 issue 41:4 95:19 138:7 285:2 issued 256:5 issues 218:12 item 183:15 184:20 193:5 199:10,14 233:25 234:10 245:13,16	j january 9:10 23:5 48:10 111:19 jargon 7:6 jesus 183:7 jim 133:5,6 job 1:25 70:3 138:15 john 210:23 211:9 214:3 224:3 joined 10:9,22 22:24 111:19 152:15 210:24 234:17,17 235:6 254:24 joint 199:7 jointly 26:24 jose 11:1 17:15 29:4,4 48:9 222:18 248:21 jrg 1:6 4:24 judge 62:6 249:16,23 263:16 judged 24:20 judgment 63:17 64:2 jump 226:8 june 1:17 2:2 4:2,7 297:11 298:3 299:3	k k 1:23 2:3 192:1 297:6 298:6 karl 20:23,24 21:1 22:10 32:14 184:13 184:25 187:1 188:4 198:15 198:15 199:23 211:11,23 217:2 233:9 235:10 238:3 238:24 242:22 243:7 244:1 249:16 karl's 184:15 187:20 kateeva 3:14 59:15 128:16 128:18,22,23 128:25 129:4,6 129:8,10,15,16 130:4,10,13,14 132:8,17,21 136:14 140:9 140:11,12 152:9,11,12,15 154:19 227:24 228:25 239:25 240:1,3 265:14 265:14,16 281:14 283:15 kateeva's 133:15
--	---	--	---

[katona - know]

katona 138:23 139:5	237:6 238:22 238:23,23	100:1,9 102:10 103:14,17,23	156:5 164:6,9 173:24 175:16
keep 24:9 25:17 58:6 173:20 207:5,14 208:20 210:6 213:7 215:18 216:5 248:17	240:6 243:14 243:24 256:22 know 7:1 9:4,6 9:8,9 12:17 15:14,17 18:18 19:8,16 20:17 20:18,19,22,24 21:15 22:4,16 23:2 29:21 30:19 34:6 35:17 36:5,8 37:16 38:6,17 40:19 41:19,21 41:24 42:5,24 44:4 48:20 50:9 51:5 53:7 53:14,16 56:2 56:12,13,20 57:12 69:8,19 72:6 79:11 81:19 83:1 86:6,22 87:2 87:16 88:1,13 89:22 90:4,8 90:10,14 91:4 91:20 92:21 93:13,20,24 94:4,8,8,15 95:16,21,24 96:10,10,13,14 97:8,15,16,18 97:19,21,23 98:1,18,18	107:12,15,17 107:21 108:11 108:12,15,18 108:18 109:6 113:1 120:13 121:4,7,9,12 125:2,8,24,25 127:25 128:10 128:19,21 129:14,16,19 130:11,14 132:13 133:8 133:10 134:12 136:5,7,8,11,14 136:16,25 137:5,6,10,15 137:23 138:6 138:19 139:2,6 139:9,12 140:24,25 141:15 144:25 146:10,11,15 146:15,16,20 146:20,21 147:12 149:3 150:6,11,17,22 151:22 152:2,7 152:15,19,20 152:24 153:2,8 153:9,12,19 154:3,3,6,8,13 154:14,19,25 155:5,6,11,25	176:22 177:2,6 177:8 178:17 179:19,22 180:6,21 181:6 182:25 184:15 185:24 186:3 187:16,18,23 187:24 189:5,7 189:16,20 190:17,23 191:15 192:2,3 192:13,23,25 195:15,25 196:3,4,6,12,13 197:5,13 198:13 199:2 200:6,10,12 201:24 202:24 203:10,16 207:22 210:22 210:24 211:25 212:7,12,15 213:6 217:4 218:20 219:12 222:25 225:25 227:1,11,20 229:15,19 230:10,20,22 230:22 231:8 232:19 234:20 235:3,9,19 236:18 239:3,4 241:8,24 242:2
keeping 213:5 236:5			
key 11:17 173:19 214:11 267:13			
kidding 101:8			
kido 176:18			
kids 138:21			
kills 107:24			
kind 27:14 41:13 46:15 72:14 83:16 94:10 109:19 127:22 131:23 149:24 150:7 150:13 158:17 177:2 185:14 187:8 212:11 217:14 226:4 237:7 280:15 286:24			
knew 21:5,22 22:4 39:22 73:4 79:19 127:23 175:14 211:23 217:9 225:17,18,20			

[know - layer]

242:5,5,10,12	286:17 287:15	kodak's 268:16	240:5 289:2
242:23,24	291:11,16,21	korean 147:19	laminar 154:20
243:8,19,21	292:9 293:25	150:11,15	lance 2:14 5:14
244:10,12	294:23 295:14	281:24	57:2 80:20
245:4,11,25	295:18	krummacher	101:7 165:13
246:4,7,14,19	knowing 87:13	71:16,18,23,25	263:6
246:24 247:10	238:25 243:7	73:1,8 254:25	lanceyang 2:16
248:4,6,20	251:7 258:21	255:6 285:6,16	land 46:6 98:22
250:6 251:24	knowledge	285:21	landing 98:17
252:15 253:12	19:22 37:10	kyle 31:12,13	landscape 7:3
253:22,22	38:9 39:2,19	31:17 32:12,13	7:11,12
256:18,20,25	64:2 73:14	188:2,4 196:10	language 72:12
257:2 259:2	91:12 92:24	199:3,23	laptop 95:22
260:17 263:6	106:18 129:7	211:11 216:20	laptops 96:7
264:10,11,24	155:24 159:8	217:2 236:16	large 11:20
265:2,10	235:20 248:14	238:3 253:17	12:22 19:24
266:10 268:9	258:20 273:9	kyle's 187:24	44:6 54:13
268:25 270:10	285:15,20	191:6	92:12 95:22
270:12,19,20	292:18	kymissis	100:22 130:3
270:23 271:2,5	knowledgeable	138:24 139:5,6	136:16 206:13
271:17,19,20	132:18	I	225:21 226:10
271:22 274:9	known 63:1	la 213:2	larger 11:8,10
274:18 275:2	68:16 128:14	lab 40:9 172:17	97:6,7 270:2
275:18,23,25	135:8 175:12	185:11 189:8,8	laser 253:14
276:4,6,9,13,14	212:23 213:5	219:8,15	late 42:1
276:16,16,18	218:7 226:4	labeled 134:24	lateral 17:18
276:19,20,22	266:23 267:2	laboratory	103:10 113:24
277:2 278:20	281:16 285:5	29:20 39:13	latest 178:5
279:3,3,4,6	knows 79:20	40:11 41:23	lawsuit 264:7
281:5,6,8,14,18	132:22 239:1,1	184:25 185:14	lawyers 35:19
282:4,7 283:2	291:12	200:17	35:19,20
283:3,5,9,15,19	kodak 18:10,12	labs 10:11,16	layer 13:20,21
283:22 284:20	18:21 65:22	10:18 21:5,5	33:18 38:3,4
284:23,24	68:21	21:13,18 31:17	39:6 40:23
285:1 286:2,14		31:18,20 39:24	41:1,2 43:9,17

[layer - licensing]

68:12 71:21	276:10 278:2	leader 15:24	242:4 244:22
75:8 76:7,23	279:2,24	267:11	246:15 257:12
77:6 85:22	280:12,16	leadership	286:1,4
89:11 94:6,18	281:9 282:24	198:7	legal 5:3 24:4
96:12,17 103:4	283:17 285:7,7	leading 34:25	24:17,21 25:25
103:13 110:5	285:20 286:25	leads 210:11,14	26:25 62:19
113:22 119:1	289:12,19,20	227:19,20	63:6,20,21
127:17 128:11	layers 11:21	leaky 179:6,9	80:13 246:20
129:9 130:16	38:17 40:1,2	179:21,21	257:16 296:16
130:19 131:10	40:20,21 41:8	learn 68:7	299:7
131:11,15,16	43:22 75:20	99:25	level 7:16,19
131:16,17	88:25 93:22,22	learned 88:13	22:2 24:9
135:20 136:2,3	94:7 109:24	88:17,23	52:18 84:10
136:12 145:5,7	113:24,24	115:20,23	92:10 114:14
145:8,13,16,17	127:16 128:5	126:5 151:4	117:18 257:4
145:19,20,23	131:18 135:3	175:14 291:22	levels 181:14
145:24 146:2	136:23 145:21	learning 19:23	290:22
146:19 151:8	151:18 155:7,8	leave 22:22	lg 92:13 269:17
151:15,18,19	167:4,14	214:16 238:7	license 240:7
151:23 153:4,6	175:18 176:7	238:12	259:12 260:11
154:9 155:1,2	177:5,8,24	leaving 37:25	261:12,23
155:3,7,12,13	178:5,6,8	250:9,12	264:7 265:24
155:14 167:7	209:10,17	led 17:17 51:10	265:24
168:4 171:8	226:24 252:20	leds 51:8 77:10	licensed 18:12
175:3 176:3,4	253:9 271:4	77:12 105:6	19:6,9,11 42:2
177:20 179:10	274:17 278:16	left 9:2 19:25	66:2 259:4,5
180:23 181:2,9	278:17 279:6	20:4,18,20	259:18 268:16
181:15 202:6	282:20 283:11	22:17,23 23:4	268:21 297:7
203:3 207:4	294:11 295:12	23:12,14 36:6	licenses 259:10
208:7,8,19,21	lcd 267:3	72:5 101:21,22	265:7
210:5,5 212:21	lcds 105:6	102:1 109:20	licensing 18:21
213:16 214:1	267:6	121:8,13	65:24 66:7
216:15 229:11	lead 115:2	125:13 135:21	240:7 260:1,16
229:18 271:14	161:19 162:2	186:23 192:23	260:20 262:7,8
275:19,20		194:5,14 195:3	263:22 264:20

[licensing - long]

266:1,15 272:19 273:3 273:10,14,24 lie 244:3 lifetime 81:17 87:6 123:8 124:4,10,13,16 124:18 125:10 125:12 126:3,7 126:20 154:25 155:11 156:6 158:9 159:16 160:11 180:18 180:22 181:1,2 181:4,19,24 182:2 293:20 lift 203:24 lifting 240:25 liftoff 214:24 light 11:16 13:6 13:19 17:3 34:25 48:21 49:2,4,7,9 67:14,15 68:2 73:5,10 74:24 75:5,14,18,19 76:7 84:13 94:15 113:21 113:21 114:4 116:12,19 118:11 119:14 120:8 173:8 177:21 255:9 255:10 268:20 273:8 285:11	286:12 lighting 13:5 15:16,17 35:13 46:11 48:18,22 49:1,12,18,23 50:3,12,13 51:11,15,24,25 67:8,13,19 68:1 77:10 113:10 114:19 115:16,23,25 133:8,9,10 lightings 45:2 lights 286:11 likes 109:4 limited 4:20,21 58:3 limiting 93:18 line 11:8,8 47:22,24 48:2 72:19 73:16,17 84:5 85:3,4,16 87:15,16,23,23 87:24 89:5,5,6 141:19 172:17 187:9 206:15 206:18,20 208:14 231:5,9 291:6 299:15 300:4 linear 85:9,14 85:19,23 110:4 lines 17:3 72:10 130:5 152:9 189:9 205:11	205:12 208:21 210:7 211:15 214:11,25 215:8,11,16,16 216:5,10 217:20 238:13 239:2,3 279:7 279:14 286:20 linger 24:24 link 133:21 134:11 158:19 linkable 202:4 linked 87:11,12 87:23,25 88:3 173:19 294:7 linkedin 23:16 linking 202:6 202:15 lion's 269:18 liq 175:20 liquid 247:9,14 248:3 list 78:23,24 109:4 245:14 245:15 253:14 285:10 listed 72:24 73:13 78:19 108:23 120:19 160:7 294:1 lists 73:11 literature 103:21 286:11 lithium 175:17 175:21 176:11	180:21 271:2,9 271:10,12 290:18 litigation 8:2 95:20 97:14 239:22 little 9:1 10:6 13:14 77:10 107:8 120:21 121:14 122:9 141:25 146:24 148:19 150:16 156:20 164:7 164:12 172:25 173:1 175:24 218:21 220:8 235:10 266:22 285:25 292:18 293:22 llp 2:8,13 lml 201:22 202:2 locally 179:16 location 46:6 98:8 172:16 locked 299:12 300:1 long 14:13,13 24:13 25:3 116:2 139:3 163:20 199:16 213:22 218:17 232:9 234:2 265:25 267:7 291:14
--	---	---	---

[longer - major]

longer 282:23	185:9 190:22	148:20 158:16	luminescence
look 23:14	208:14,15	162:17 165:8	71:21
32:25 41:19	239:13,16	166:6 173:22	lunch 111:5
54:9,15 63:20	252:11 272:19	176:21 178:18	m
73:15 78:13,23	273:3 274:6	196:6 198:17	macroscopic...
81:15 99:5,5	looks 84:9	198:18 218:21	179:15
100:18 103:21	108:6 183:23	222:2,3 226:10	made 15:13
106:7 125:17	186:7 252:6	237:17 254:18	27:3 33:22,23
141:1 146:24	256:20	255:24 258:22	33:25 38:7
148:7 149:21	loosely 104:6	264:2,11	80:9 89:25
149:22 151:4	los 2:9 297:4,7	268:10 270:1,4	92:19,25 95:23
159:23 183:3	298:2	281:22 292:9	96:11 114:24
185:21 186:17	lose 137:22	292:20	128:25 129:6
186:25 187:20	174:4 181:24	lousy 161:25	142:9 143:1
189:6,7,12	182:1 196:20	love 109:4	169:15 217:17
195:8,16 199:9	loses 37:20	low 37:17	273:12 279:10
202:25 227:23	loss 154:25	128:6 140:19	293:17
228:13 229:16	155:11	166:12,14	madigan 132:9
229:20 234:9	lost 121:7	169:15 170:20	132:13
238:17 242:25	264:7	177:22	main 43:5
245:12 262:19	lot 12:5,20 17:7	lower 51:4	51:23 107:22
279:17 291:24	19:22 22:17	182:4 186:23	148:21 295:2
looked 33:5	29:9 32:20	188:22 194:5	maintained
54:16 70:15	39:23 41:22,22	195:3,5	250:6
125:1 141:14	41:25 45:22	lpts 167:15	maintaining
141:23 146:17	46:13,23 47:2	173:11	117:12 138:2
147:24 223:2	49:18 50:2,2	ltp 172:21	maintenance
240:1 256:7,8	55:22 56:13	ltps 166:22	138:6,8
262:18	59:22 68:21	167:5 168:2,11	major 18:6
looking 34:11	88:12,23 92:14	168:16 169:15	43:9 60:2
34:13 45:3	96:24 108:10	169:21 171:6	130:14 166:21
100:15 101:5	119:2 121:16	171:16,17,20	262:7 282:12
109:23 116:15	123:21 127:24	172:1,6 173:2	282:14,15,23
124:24 125:18	137:22 147:9	173:5 174:9,11	283:8,14
125:19 142:2	147:25 148:18		

[majority - masks]

majority 33:23 64:15 130:5 205:8 230:5	28:18,23 43:11 198:1 226:10 226:13	83:9,24 89:19 140:3 152:9,17 154:4 166:8	90:23 91:5,14 92:7,10 93:14 93:19 94:5,9
make 19:15 22:20 26:16 30:18 31:8,18 43:18,20 46:5 67:18 68:7,11 82:14 102:25 113:18,21 117:21 118:10 119:14 141:19 142:14,14 144:3 145:19 171:3,19 200:15 209:17 211:24 221:19 260:24 268:11 269:14 279:9 299:14 300:3	manager 9:25 managing 17:19,20 41:3 278:7 manella 2:8 5:13 manifest 73:12 99:2 manufactura... 46:9 81:10 99:10 123:3 226:19 278:16 manufacturable 214:9 278:9,10 279:9 manufacture 84:16 259:4 260:25 264:21	219:25 220:14 221:5 260:24 261:18 264:1 264:20 271:19 276:3 291:6 map 69:21 march 55:8 56:23 57:19 58:10 mark 129:21 129:22 marked 71:1 78:10,11 100:10 104:10 116:8 132:4 148:4 182:11 market 3:12 96:3 143:2 220:15,16 261:17 269:16 269:23,24 270:2 marketing 105:1 135:5 marketplace 79:18 283:6 marshall 1:3 4:23 mask 87:8,12 87:14,22,22 88:3,11,24 89:12,17 90:14	94:10,11,22,25 95:2,16,23 96:22 97:4,9 97:20,22,24 98:13,21 99:16 100:6 103:4,11 103:12,13,18 103:19 127:8 127:10 134:25 135:1 140:20 143:6,10,19,23 166:15,18 206:11 207:9 207:16 208:8 209:2,10,16,19 209:21,22 212:3 216:17 230:2,3,9,18 276:24 286:15 294:8,10,22 295:1,4,13,22 masking 207:23 209:13 209:16 213:12 214:18,19 216:14 217:3,3 286:24 293:24 295:8 masks 16:19 92:20 93:1,3 94:21 96:6,16 127:10 146:8
making 33:4 50:1,3 103:9 151:11 171:17 173:11 248:16 262:9 268:10 270:6 281:10 282:10 malaysia 11:9 11:10 manage 16:25 managed 13:15 96:20 97:3 108:8 115:22 management 24:6 25:12	manufacturers 160:12 manufacturing 19:22 33:2 39:3 48:3 50:8 81:5,12,12,22 82:13,20 83:4		

[masks - mean]

226:5 229:17 239:9 280:16 295:11 mass 3:15 11:11 34:15 40:3 67:22 84:10,11 86:18 92:16 132:9 135:24 150:8 166:11 219:23 226:20 231:1 270:3 master 254:20 255:1 material 16:8 20:14 60:2 68:17 72:23 73:3,20,21,22 74:7,10,13,21 75:4,11,17,20 75:20,25 76:1 76:5,8,9,19,21 76:21 77:12 81:16,23 82:9 82:12 83:11 84:2,9 85:5 94:14 98:22 127:4,5 130:24 137:23 138:5 169:12,23 170:6,20 174:23 177:13 177:24 179:16 179:18 204:10 204:17,21,23	205:7,15,16 215:22 225:3 229:13 247:16 266:13 271:13 271:22 288:4 290:9 291:25 292:1 material's 83:21 materialization 137:10 materials 3:8 13:18,21 16:11 16:23 17:1,8 17:13,14,19 19:10,11 20:20 45:17 69:4 74:14,20 76:18 77:14,15,16,17 78:5,19,24 81:5,19,20 82:22 84:19,23 88:17,20 129:1 129:5 135:8 137:21 139:23 141:6,13 142:2 142:5,10 168:13 173:9 175:6 176:12 178:2 179:8,9 179:24 180:2,4 203:25 210:7 212:11 215:23 224:24 238:9 238:14 248:5	260:6 274:9 276:15,23 282:1,10,11,12 282:15,16 286:10 288:12 288:14 289:10 290:15 292:2 mathematical 158:22 mathematically 159:4 matrices 141:2 141:5 matrix 11:24 12:8,14 19:17 33:3 48:5,7,12 48:19 51:18 73:19,21,22 74:7,12,14,20 74:21 75:4,11 75:17,20,25 76:3,6,7 77:2,3 77:12,16 108:3 110:14 140:16 140:18 186:15 221:6 260:23 matter 4:19 22:3 49:3,19 50:10 66:10 89:6 140:7 142:9 151:12 158:17 165:12 177:23 201:1 250:3 252:13	matters 81:12 mature 135:25 maturity 52:1 mean 7:11 27:17 40:18 44:16 52:23 62:11 64:10 66:25 68:9 74:7 75:17 82:19 85:13,17 95:22 104:7 107:7 109:8 127:2 129:2 135:7,10 138:9 141:17 145:16 146:1 151:1,3 152:2 154:5 164:21 165:3 166:16 167:21 173:20 177:18 189:24 191:18 192:12 196:20 198:15,16,23 200:17 201:12 212:1 213:6 216:1 218:22 223:18 227:15 228:11 230:11 230:23 231:10 236:5,16 239:7 244:4 246:4 249:10 254:6 258:6 262:17 263:6,7 264:1 264:3 267:18
---	---	--	--

[mean - mine]

267:24 269:1 272:15 274:2 274:19 279:17 290:17 means 73:25 133:11 168:1 180:5,6 196:5 202:19 220:11 235:19 236:8 238:24 meant 13:15 113:20 114:3 164:2 measure 161:13 measuring 150:8 mechanical 31:22 mechanics 151:17 media 4:16 68:25 69:3,3 73:11,12 296:15 medium 91:22 meet 24:6 25:16 26:1,19 26:21 146:6 290:9,15 meeting 27:4 126:9 meetings 25:21 60:6 197:25	member 9:17 9:22 members 28:22 117:23 memories 182:14 183:11 memory 240:20 mentioned 13:10,12 15:19 72:1,2 96:5,15 117:1 201:16 201:21,22 206:9 213:18 213:19 217:25 257:15 280:1 280:10 286:7,9 286:10,12 messages 139:25 met 21:3,14 220:19 metal 33:20 37:13,18 87:8 87:12,22,22 88:3,11,24 89:12,17 90:13 90:23 91:5,14 92:7,9,20,25 93:3,14,19 94:5,9,10,21,22 94:25 95:2,15 95:23 96:16,22 97:4,9,20,22,24 98:13,20 99:16 100:6 103:11	103:12,12,18 108:7 127:8,9 127:10 134:25 140:20 143:5 143:10,19,23 166:15,17 180:8,14 210:11,14 211:2,15 212:11 213:7 213:11 214:10 214:12,25 215:8,11 216:5 216:10,16 217:20 230:2 236:3,4 237:24 238:6,13 239:3 268:20 270:17 275:21 279:13 294:8,10,22 295:1,4,8,11,13 295:22 metalization 16:20 85:2 119:7 260:7 metallic 110:11 177:10 209:24 215:16,18,23 286:20 metals 176:5 181:8 212:1,2 212:16 230:5 233:17 242:19 242:20 252:3 290:25	method 37:9 147:3 153:5 206:12 212:23 218:7 281:9 methods 211:12 236:8 237:22 micro 31:18 68:24 105:6 mid 173:8 221:10 223:9 middle 183:23 184:4 188:25 221:1 235:1 migrate 154:8 millar 138:24 139:5 millimeter 11:7 44:14 48:13 85:3 million 14:9,10 14:22 15:5 113:3 millions 144:12 mind 30:4 42:23 44:12 66:17 116:15 116:16 120:21 159:25 233:14 235:1 237:20 238:18 240:12 241:10 248:17 256:9 mine 189:16 195:8,12
---	--	---	--

[minimum - multiyear]

minimum 236:10	modes 158:18 159:2 205:24	monitored 268:12	motorola 213:1 213:15,18,19
minute 55:12 58:2 112:9 231:12	modifications 45:14	monitoring 59:8 60:9	213:22 214:2 229:21
minutes 52:6,7 296:5	modify 45:17 88:24 289:3	monitors 91:16 91:17 95:23 96:3 97:7 266:5,19 295:9	motorola's 240:13
misfires 46:7	modulated 174:22 175:4	monochrome 11:24 48:12,15 141:19,20 260:7	move 14:19 15:9 34:3 112:24 258:5
misfirings 145:12	module 16:7,15 16:18 19:15 119:15	monochromic 141:22	moved 55:17 56:17 57:25 91:18 121:5 127:7 198:20 217:16
misplace 98:25	modules 10:5	monomer 151:14	moves 197:5
misplacement 144:15	moieties 291:8 291:16	monomers 150:9,13 151:2	moving 198:8
misprints 46:7	molecular 289:5	month 25:16 26:20 58:4 164:10 198:24	multi 39:6 159:2
missed 290:11	molecule 75:24 291:12	monthly 25:21	multidimensi... 45:8
mistake 140:14	molecules 178:11 289:6 294:7	months 6:14,20 21:17 23:3,4 24:24 25:1,2,3 25:6,7 47:5,5 54:8,14 55:4	multilayer 85:9 208:3 279:4
mit 132:25	moment 182:18 296:4	months 6:14,20 21:17 23:3,4 24:24 25:1,2,3 25:6,7 47:5,5 54:8,14 55:4	multimillion 112:17
mix 176:4	money 47:11 108:9 117:12 132:22 258:15	morning 4:5 5:20 6:7 225:13 285:10 293:4	multiple 32:9 42:10 44:6 82:23 114:5 155:7,8 159:13 162:8 176:2 216:18 264:13
mixed 176:12 180:23 262:11	monice 1:23 2:3 5:21 133:21 297:6 298:6	motivation 210:21 211:16 241:11	multiyear 112:17
mixing 135:2	monitor 59:17 59:25 61:20 89:25 96:18 100:3		
mixture 180:9			
mixtures 176:5 176:7,23 178:8			
mm 101:2 106:4 194:18 208:2 254:7			
mobile 34:7 95:3,9 96:7 159:9 270:14 295:20			
mode 40:4 158:25 159:1			
model 128:17			

[n - novelty]

n	necessary	needs 57:14	nonselective
n 3:1	167:22,22	83:17 262:18	126:21 127:20
name 5:2,21	259:10,13	negate 81:22	153:15 204:18
6:8,9 16:16	261:11 265:7	82:3,21 83:10	noon 111:4
20:22 22:10	299:14 300:3	169:11	normal 170:21
104:25 118:17	need 23:14	negative 173:6	normalized
183:21,24	37:17 40:4	290:21	161:3
191:11 236:21	41:19 43:12	neighbors	northern 17:9
243:4 267:4	45:14 49:20,20	178:14	northwest
281:25	54:9 72:12	neither 238:3	39:12 41:23
named 31:12	75:1 81:23	network 108:2	nos 1:5
254:22 280:9	82:21 83:11,15	never 38:14	notating
names 231:25	85:10 94:11,20	50:12 189:15	299:15 300:4
232:4,6	106:2 107:8	229:6	note 4:8 196:10
nano 266:2	109:5 115:9	new 20:14 24:3	notebook
nanosolar	131:1 138:8	30:8 68:22	185:22,25
22:24	144:24 146:24	71:5 79:19	186:18,18
nanosys 59:15	151:25 153:24	88:18 99:24	190:6,8,10,13
265:22,25	154:1 160:15	158:17 211:25	190:25 191:24
266:15,19,24	162:9 168:3,25	213:10 241:13	192:11 195:10
267:9	170:15,22	248:1 252:2,3	notes 188:7
narrow 58:3	175:9 178:18	252:4 258:1	195:23,24
65:16,18	179:23 183:4	newer 98:7	196:1,7 297:16
120:12 156:11	200:6 210:10	nice 296:10	297:19
180:14	212:1 227:6,8	nitride 128:7	noticing 5:11
natural 119:16	227:9,19	131:11 213:6	notorious
nature 88:16	229:20 237:9	276:17 282:19	40:12 263:22
nearest 178:14	242:24 250:3	nitrides 213:3	noaled 176:21
neat 176:24	262:19 275:2	nitty 117:21	265:12
necessarily	286:23	nobel 69:9	novel 62:12
134:23 157:12	needed 33:8	non 155:22,23	63:7 66:21
161:19 162:2	126:2 210:6	156:3 273:20	241:12 247:24
169:13 206:7	291:8	279:13	248:8
213:2	needing 94:14	nonobvious	novelty 62:15
		63:7	

[nozzle - obtain]

nozzle 142:5	o	152:25 153:7	233:7 234:15
nozzles 154:1,2	oath 5:18 6:2	153:16,22	235:8 237:3
number 3:6	object 8:11	154:11 155:4	241:5,22
4:23 5:22	92:6 241:3,5	155:15 156:7	242:17 243:6
16:16,17 43:6	objecting 57:13	156:19 157:6	243:17,25
71:1,15 78:10	objection 8:12	157:14 158:14	244:17,24
78:11,14,15	8:23 18:16	159:11 167:9	246:3,17 249:4
100:10 101:13	19:2 20:8,16	167:25 168:14	249:9 250:10
104:10,15	27:7,18 28:9	172:4 175:19	250:14 251:5
105:9,9,15	30:15,24 32:7	176:14 177:16	251:15 253:10
116:8,13,17,21	33:10 34:5,22	178:3,25	253:19 254:17
116:21 122:14	38:19,21 39:17	180:12,24	257:23 258:11
123:6 132:2,4	41:10 44:10,23	181:5,21 185:6	258:19 259:1
148:4,10	46:19 50:6	185:23 186:4	259:14 260:14
161:14 164:8	51:22 53:23	186:19 187:3	261:13,25
170:17,19	56:7 61:6	187:12,17,22	263:3,14 264:9
179:22,23	62:14 63:3,18	189:1,14,22	265:3 266:6,21
182:9,11,23	64:3,12 66:15	190:11,20	267:16,23
183:16,19	66:22 70:9	191:4,17 196:2	268:5 269:6,13
184:20 185:1	73:23 74:16	196:11,18	270:18 271:16
185:18 188:15	75:6 81:7,25	199:5 200:4	272:7,14 273:5
199:10,14	83:18 84:6	202:12 203:9	273:25 275:22
218:16 226:14	88:5,7 89:21	203:15,21	277:1 279:15
227:24 233:25	90:17 91:7	204:19 205:13	280:2,13,23
234:10 236:11	103:6 104:24	205:21 206:4	281:2,13 283:1
245:13,16	105:23 106:22	207:7 208:10	283:12,21
247:18 294:15	107:6 108:25	208:23 209:11	284:3,12 285:8
296:14 299:15	109:22 113:16	210:8 212:13	285:17,22
300:4	114:11 115:4	215:1,25 216:2	288:6 292:14
numbers 8:1	115:14 122:7	216:12 218:19	293:11,21
109:5 156:24	122:24 124:7	219:16 220:6	objections 5:6
185:4 255:22	126:25 130:22	221:13 223:12	57:4,7 65:2
270:10	136:13 137:8	224:11 228:9	obstacles 206:6
nv 1:24	137:14 139:16	229:25 231:7	obtain 261:11
	141:3 149:7,15	232:7,15,25	261:22

[obvious - oled]

obvious 66:21 166:16 227:9 244:4 247:23 248:8 252:6,12 252:18,21,22 252:24 256:19 274:7	291:24 okay 6:24 7:23 8:6 10:22 14:6 15:8 16:1,13 18:9 19:25 20:3 21:20 27:2 28:7,14 31:4,16 37:1 47:25 48:6 55:4 56:16,22 58:10,16,22 59:13 60:12,22 61:17 63:24 64:15,16 70:19 72:9 80:11 82:12,17 85:25 87:18 92:18,23 95:7,18,25 96:14 102:25 104:17 107:7 108:12 112:23 114:23 121:9 122:22 124:23 126:18,19 127:12 130:1 133:7 134:5,8 134:14,18 138:13 144:9 144:10 152:4 155:18 160:7 165:9,18 167:3 186:2,17 188:6 190:15 192:8 192:22 195:9 195:25 196:24	197:2 201:5 208:4 212:7 215:17 217:21 217:25 219:12 220:23 228:13 230:8 232:3,13 239:6 241:9 242:11 245:9 245:12 247:6 250:22 251:21 255:13 256:3 256:14 257:3,7 262:13,24 263:18 274:15 275:18 277:6 277:21 284:22 285:5 287:6,23 295:16 296:2 old 212:10 oled 3:15 7:2 7:10 8:7,18,22 8:24 9:7,12 10:4,8 12:2,8 12:14 13:18,21 15:9,20,23 16:8,13 17:7 17:24 18:3,4 18:13,24 22:2 22:8,14 23:19 24:20 32:4,22 33:1,9,25 34:12,20 36:2 36:13 40:14,15 40:17 42:13,16 43:7 44:18,21	45:1 46:4 48:8 48:15,25 49:11 49:11 51:10 58:23 59:1,5 60:2,8 61:14 61:18 62:3 63:13 65:21 66:4 67:18 68:5,8 71:21 74:15,23 75:12 81:5 82:7,9,14 83:4,12,17 85:10,11 86:19 89:9,10,11,18 89:24 90:6,15 91:6,15 92:19 92:25 93:21 94:10,14 95:25 96:2,9,11,12,17 96:18,24 97:11 98:12 100:2,7 111:18,23 112:2,16,24 113:5,9,10 114:23 116:12 116:19 118:4 121:11 123:3 128:25 130:5 131:20 132:8 132:18,22 135:3 140:1,10 141:1 142:23 159:8 160:21 162:15,16 166:7 167:6,16
--	--	---	---

[oled - organic]

168:7,22	44:2 50:20	ongoing 221:11	opposite 143:6
169:17 170:11	60:1 67:6,23	open 103:18	optical 161:13
171:8,17,19	68:11,13 69:12	148:13 214:25	161:22
172:7,24 173:6	76:11 93:12	238:13	optimization
173:15,22	94:12 105:5	opening 87:17	171:19
174:1,1,10,17	112:7 128:7	104:16 116:6	optimize 90:25
174:17,23,25	131:21 143:3	openings 87:15	171:13,16
177:4 196:7	143:12 158:23	209:18	optimized
207:21 208:8	162:12 167:23	operate 173:4	120:10
209:2 213:20	168:5,19,20	210:9 259:7	option 229:12
213:21 218:2	171:3 173:12	261:18	optional 101:22
221:19,23	174:8 175:13	operates	order 47:20
222:13,17,21	214:22 224:5	170:14	83:2 126:2
225:4,5 227:16	224:10 230:25	operating	201:15 261:12
229:23 231:1,5	244:7,9 252:4	161:24 175:9	290:9,15 291:8
259:18 260:23	252:23,25	operational	294:11
266:5,18	259:8 264:3,4	159:15	ordinary 70:7
267:14 268:3	268:7,8,10	opine 279:18	organic 39:6
269:5,10,19	269:16 270:5	292:3	40:1 41:1,2,8
270:7 278:11	281:11 282:8,9	opining 79:6	41:15 43:16,22
279:22 283:8	282:9,17	opinion 60:17	69:4 127:15
287:25 288:4	287:22,23	60:21,22,25	128:11 129:9
288:12 289:16	292:7,8	61:3 62:2 65:9	130:16,19
292:6 295:8,16	omdia 104:18	65:11 66:12	131:20 135:20
295:19,23	104:19,21	81:3 86:1,9,24	136:1,3 145:5
oleds 10:11,14	105:15 110:22	87:20 88:2	145:7,13,16,19
10:19,20,23	omitted 243:3	90:9 111:22	145:20,23
11:15,20 12:19	243:15,23	229:9 248:7	146:2,5,13,19
12:21,23 18:7	once 25:16,20	257:8 273:2,19	151:8,18,19,23
18:8,9 21:11	26:4,12 27:2,2	274:3 275:7,9	153:4,5 154:9
22:11 34:24	28:3,3 36:6	275:10	155:1,2,7,14
35:3 36:4,7,11	147:19 202:15	opinions 79:19	167:4,7 169:12
36:13 40:24	one's 136:9	opportunity	169:23 170:6
42:8,10,24,25	ones 44:7 80:9	48:21	173:9 174:22
43:4,10,11	89:9 260:5		208:7 210:5,15

[organic - page]

213:16,25 214:1 215:22 216:15 229:18 236:6 248:3 252:19 271:13 274:17 275:19 275:25 276:10 278:1,16 279:1 279:24 280:12 280:16 281:5,9 282:3,6,20,24 283:11,17 286:10,25 288:4,12,14 290:9,15 291:8 295:12 organics 131:20 146:6 209:14 212:2 214:13 216:6 216:11 237:24 organization 16:6 24:1 104:21,23 organizations 105:1,3 organized 118:1 292:17 original 12:18 40:14,16 43:15 265:18 299:10 299:20,22 originally 8:4 227:12	osmosis 291:22 osram 8:4,8,18 8:21,24,25 9:4 9:6,12,13,16 10:9,22 11:4,9 11:18,19 12:2 12:3,13,24 13:15 14:5,9 14:19,24 15:3 15:9,15 16:16 18:2,25 19:20 19:25 20:5,10 21:7,25 22:4,6 22:17,22,25 23:3,6,18,23 24:1 29:22 30:2 31:15,20 31:25 32:1,25 33:2,12 34:11 35:11,13,25 47:9,18 48:1,7 60:17 61:23 62:25 66:2 72:2 111:18,22 112:1,6,15,24 113:3,9 114:9 114:24 117:13 118:4 140:15 140:18,25 186:8,18 199:4 210:1 229:3 234:14 235:6 237:1 241:2 243:10 244:7 246:20 248:18	254:6,13,19 257:16,25 258:17,24 259:10,12,18 259:22 260:2 260:10 263:19 osram's 15:23 34:20 35:9 44:20 121:10 121:10 263:11 273:22 outcome 5:6 297:22 outer 144:25 outgassed 202:4 outgassing 150:10 output 161:13 outside 19:6,9 19:11 173:16 174:19 239:22 245:20 overall 16:6 24:1 117:19 overcome 140:2 overlapped 21:20 255:8 overlapping 35:23 overview 11:3 267:21 own 24:22 66:18 130:12	177:9 182:16 241:2 251:22 258:22,25 owned 273:8 owner 262:15 262:21 263:1 264:17 ownership 265:7 owning 264:20 oxides 213:3 oxygen 43:7,9 43:20
p			
p 189:3,5 p.m. 111:11,14 112:13 163:6,9 231:15,20 296:17,20 pacific 4:6 39:11 41:23 296:17 packaging 119:10 147:11 packard 10:11 21:18 289:2 pad 210:6 pads 208:20 213:5 214:10 214:16 238:6 279:13 page 3:2,6 72:16 80:3,4 98:18,24 100:23 101:3,9			

[page - particular]

101:10,12,16	200:7 201:6	113:12 115:13	287:1 291:3
101:16 104:17	215:12,14	159:9 225:21	parted 22:16
105:8,9,11,14	227:25 228:2,5	271:23	partially
109:12,24	228:19 233:22	paper 46:3,3	288:20
110:22,25	238:18,19	68:23 189:11	participant
119:17,21	245:1,16	papers 103:22	246:21
120:17 124:12	256:20,20	133:4 219:10	participants
124:24 126:10	294:2 299:15	paragraph	4:11
133:13,15	300:4	86:20,21	participate
134:20,22	pages 79:11	159:24 160:2	60:6
147:20 148:1	80:4 149:22	206:25 285:10	participated
148:17 149:12	159:23 160:2	paralegals	29:7
149:19 150:3	164:18,22,24	26:23	participates
159:25 160:3,3	165:2,6,10	parallel 83:20	161:22
160:3,4,4	185:1 189:21	219:5 246:12	participating
182:24,24	190:4,10	parameters	28:24
183:1,9,10,13	192:10,11,15	82:24 173:19	particle 136:25
183:19,20,20	193:19 195:10	181:13 182:3	154:18,23
184:5,10,11,11	195:16,18	269:10,12	224:24 226:13
184:11,18	231:24 232:3,5	part 10:24 13:1	226:15 278:7
185:4,17,22	299:14,17,17	16:15,17 19:4	particles 37:13
186:11,12,13	300:3,6,6	19:5,8 33:1,5	41:3,3 43:11
186:14,18	paid 12:5	34:16,18 35:24	43:13 127:24
187:2,8 188:14	panel 13:24	36:13 44:18,20	137:7 147:9,11
188:15,17,18	44:8 90:21	45:2 48:10,23	151:20 152:21
188:21,24	115:3,23 174:8	51:19 62:16	166:10,10
189:3 190:9,12	269:5 283:8	71:20 78:2,4	173:12,14
190:18,23,25	panels 44:6	79:3,23 83:4	226:11,14
191:1,7,8,8	48:22 68:8	113:8 114:23	particular 6:19
192:2,7 193:2	89:25 90:6,16	118:18 131:20	19:14 22:12,14
193:3,4,5,10,13	91:6 92:19,25	163:13 166:7	23:22 36:17
193:16,19,24	93:21 96:1,9	199:16 200:22	55:17 61:19
194:4,8,9,13,19	96:11,18 97:6	221:18 223:5	63:5 69:10
195:3,20	97:7,11 100:2	234:1 236:25	72:6 74:9 80:2
199:10,21	100:3 112:2	264:22 271:13	86:21 105:19

[particular - perceived]

120:25 159:24 197:21 204:17 221:16 240:11 242:21 262:10 262:22,25 267:25 274:2 279:17 288:24 particularly 217:10 parties 4:15 272:3 297:21 partitions 205:23 partners 266:14 parts 83:5 167:22 172:23 party 5:4 30:18 30:18 260:10 261:9 party's 272:25 pass 296:6 passing 157:17 passive 11:24 12:8,14 19:16 33:2 46:3 48:5 48:7,12,12,19 51:18 140:16 140:18 186:15 221:6 260:23 past 96:5 125:21 155:25 282:21 patent 3:9 23:23,24 24:4	24:9,23 25:17 26:6,22,23 27:5,11 28:8 35:19,20 53:16 62:16 64:20,22 65:7,10 66:1,3 67:5,7,25 68:1 68:7 69:11,15 69:24 70:25 71:15,16 72:1 72:2 74:8 121:22 145:6 145:18 196:4 197:14 198:1,9 198:20 199:7 214:2,3,4 233:19 240:11 240:14 241:2 241:25 245:2 247:6 249:1,3 250:13 255:20 256:5 258:5,18 262:21,23 263:1 264:17 274:15,22 275:6 277:8,23 285:23,24 286:4 patentable 237:21 251:18 252:8 patented 262:25 263:19 patenting 27:6	patents 7:19,20 7:23 8:2,3 23:18,21 41:20 52:19,20,25 53:2,5,22 54:23 58:20 60:18,23 61:1 61:4,24 62:1,3 65:12,23 66:5 66:7,9,13 67:17 72:4,5,8 78:4,25 79:3,5 198:17 212:25 213:23 227:10 229:16,21 237:6 240:13 252:1 254:23 254:24 255:24 256:4,7 257:8 259:5,11,12,18 263:12,23 264:25 267:2 274:12 275:14 279:25 280:10 284:1,2,4 286:19 path 13:23 43:19 140:9 179:17 260:25 264:20 paths 13:18 179:6,9,21 pattern 103:11 119:6 252:25	patterning 115:21 131:23 135:1 252:23 pause 261:6 paying 263:1 263:12 pdf 101:12 105:8 182:24 183:1,19 184:11 185:17 186:13 190:25 199:21 299:12 300:1 peel 210:20 225:4 peeling 126:7 126:13 174:4 penalty 171:15 299:16 300:5 penang 11:9,10 16:5 29:3 222:19 pending 57:13 57:15 246:10 people 28:14 29:2,3,3 30:5 40:10 138:19 154:8 166:25 182:14 197:13 206:2 219:11 250:9 254:4,9 255:3,11,16 270:4 281:22 perceived 79:10 123:15
--	---	---	---

[percent - pichler]

percent 14:4 38:12 42:21 43:1 57:21 61:20 95:5 99:21 107:4,25 109:2 110:24 115:16 123:7,9 125:17,18 128:24 129:5,8 158:5 161:5,23 169:14 186:3 187:4 189:16 203:11 205:15 269:16 270:20 276:11 percentage 125:13 137:16 161:6 270:3 294:15 percentages 150:13 270:13 perfected 166:13 295:6 perfecting 143:11 perfectly 202:9 perform 123:9 152:12 performance 17:2 40:13,23 83:21 86:4,11 169:1 178:16 220:18 288:18 288:19 290:10 290:16	performing 120:15 283:9 performs 178:16 perimeter 144:25 perimetry 145:13 period 21:21 23:9 54:12,13 54:25 55:21 58:17 130:3 220:25 221:9 246:6 299:18 300:7 periods 54:10 perjury 299:17 300:6 permission 261:18 permit 7:16 perryman 139:9 person 56:16 58:11 70:7 201:5,9,12 244:16 246:25 249:8,25 289:8 person's 243:4 personal 79:15 90:9 137:3 244:18 246:19 262:2 274:3 275:9 277:10	personally 135:4 274:5 perspective 70:7 ph 254:15 281:25 ph.d. 21:1 132:25 phd 1:16 2:1 3:2 4:18 5:24 296:14 297:11 299:5 phds 32:14 phenomena 73:13 philips 35:6 phones 91:19 91:22 93:3,4,8 95:9 96:7 270:15 295:20 phosphide 267:12 phosphor 67:9 phosphoresce... 268:22 270:17 270:21 273:12 phosphors 67:13 69:5 255:8,10,13 286:2,5 phosphorus 77:15 photolithogra... 90:2 119:7 214:19	photonic 77:7 phonically 289:22 290:1 photons 107:25 161:5,14 290:2 photoresistor 204:23 photovoltaics 158:23 262:6 physical 289:17 289:18 physicist 151:10,10 physics 22:19 288:9 pichler 20:23 20:23,24 21:1 22:10 32:12,16 63:12,24 184:25 188:5,7 188:10,24 192:1 199:15 199:23 201:10 201:11,16 203:1,7 208:5 211:19,23 214:21 215:2,4 222:21 233:6,9 234:13 235:11 236:16,24 237:14 238:4 238:11,21,24 240:16,23 243:3,14,23 244:12,15
--	--	--	---

[pichler - point]

245:17 246:1 246:24 247:12 249:8 250:19 250:23 251:3 253:17 255:21 257:12 pichler's 184:14 187:1 187:10 188:3 189:12 191:2 257:8 pick 80:1,11 259:22 picked 80:17 pictiva 1:4 4:19 7:19,20,23 8:3 8:6 10:4 16:16 52:19 53:21 54:22 60:17 65:12 66:9,13 97:13 140:6,12 140:13,15 240:11 256:7 274:6,12 283:25 299:4 pictiva's 163:15 picture 101:20 258:21 piece 189:11 pilot 11:8 48:1 231:3,4 pinholes 151:22 179:3,4 179:5,8 180:5	180:5 pins 205:3,5 207:5,15 pioneer 39:21 111:23 pioneered 11:19 39:7 217:13 225:9 260:4 pixel 99:1 142:23 144:1 144:11 162:7 162:18,24 168:4 169:18 169:18 173:3 pixelated 48:19 50:2 68:2 215:14 pixels 49:13,14 49:15 94:6,6 98:9,14 99:19 99:20,20 100:8 104:8 113:13 115:9,9,18 143:12 144:16 144:22 162:9 162:11,16,17 167:8,14 168:4 169:2 170:3 253:5,7 270:16 294:21 pixilation 49:19,21,22,25 place 4:14 45:15 56:21	57:23 229:7 placed 144:22 placement 142:13 plain 49:6 plaintiff 1:5 plaintiffs 2:7 4:18 5:13 planar 291:12 planarization 131:15 136:12 177:19 planarize 43:14 167:13 planarizes 173:14 plantar 278:17 plasma 124:25 173:23 174:6 209:13 276:20 plate 206:13 play 93:16 117:16 player 130:15 playing 144:5 289:21 290:24 plays 76:3 97:18 please 4:8 5:7 5:17 6:7 10:6 28:21 46:21 57:7 61:16 70:23 72:9,17 82:5 100:12 104:12 105:8	109:17 116:4 119:17 127:1 127:16 129:4 131:25 132:12 133:13,18 147:5 148:13 164:20 182:7 185:17 199:9 209:20 217:5 245:12 251:1 261:4 280:5 plot 110:21 plots 158:21 plug 161:9 plus 14:22 30:6 59:22 110:18 235:17 pml 201:21 207:25 210:22 213:2 215:3,19 227:12,15 235:18 240:5 240:14 247:25 279:8 pockets 136:22 144:12,24 point 8:19 18:19 49:1 53:9 85:15,19 85:23 98:6,7 106:8 151:16 168:17 228:14 229:10,22 288:9 289:23
---	--	--	--

[pointing - printing]

pointing 190:21 287:11	possibility 113:11 243:22	precursor 151:24	292:18
polarizer 106:11 107:1 107:24,24 108:1,2,4,9,20 110:3,4,7,9,18	possible 71:3 169:19	predated 242:23	previously 203:2
polarizing 109:18,25 110:13	post 248:14	preliminary 46:16 47:4	primarily 11:15,23 12:21 42:12,24 53:10 53:19 85:21 95:3 108:19 216:5 284:1
polycrystalline 169:16 177:11 180:4,5	postdoctoral 59:3	prepare 119:8 163:21 170:1	primary 108:20
polymer 48:21 116:11,19 178:22,23 208:2	postponed 58:8	prepared 138:11 163:11	princeton 66:6 132:25 133:2
polymers 11:16 13:6 34:25 66:4 84:14 289:6	potential 84:15 116:1 229:1 289:13 290:23	preparing 163:14 165:20	print 36:21 37:10 141:1,12 142:4 212:3 253:25 279:24
polysilicon 166:13,14	potentially 65:10 251:17	presence 12:17	printable 131:16 143:3
portfolio 258:2	power 50:22,24 51:4 90:25 107:22 109:8 110:24 114:5 119:11 160:22 161:8,17,19,20 161:22,23 162:3,14,17,21	present 2:17 29:9 63:6 69:6 151:21	printed 13:25 37:12 46:4 89:16 113:13 153:14
portion 88:9 140:19 155:13 270:21	powerful 65:23 66:3,6	presentation 3:14 132:7 227:24 228:22	printer 45:1 46:2 141:11,12 141:14,16 151:19
position 35:1 282:18 287:11	ppi 294:21,21	presentations 36:9 43:24,25 283:4	printers 129:4 129:6,11 130:4 130:10,12 141:15 152:16 283:16
positive 173:6 290:20	practical 51:9 214:9	presented 27:25 185:13 198:16	printing 13:5,8 37:22,23,24 38:8 41:17,20
possession 73:8	practice 29:19 40:3 146:12 216:22 217:23 232:13,17 248:19 249:2	presenting 229:1	
possibilities 141:23	precise 88:25	pressure 174:1 174:3	
	precisely 144:13	pretty 119:1 166:20 252:12 254:13 295:11	
		previous 89:14 235:21 240:12 254:11 279:5	

[printing - product]

44:22 45:4,7	253:1,9,13,14	242:2,5,22,23	212:16 214:9
45:14 46:3	253:15,24	243:8 247:5	214:24 215:4
50:11,15,19	254:1 276:10	252:8 292:17	226:16,22
51:17 52:1	279:22 280:11	problem 43:10	229:14 230:9
84:12,23 90:3	280:20 281:1,9	128:4 174:5	231:1 241:16
92:15 93:18	281:16,21	238:9 248:13	241:17 246:22
96:12 99:12,14	282:4 294:24	problems 128:1	252:2 274:16
99:16 104:7	295:3	procedure	276:3 278:8,25
114:15 115:21	printout	23:22 197:6,15	279:4,12
118:13 130:18	186:15	299:19,21	281:10 290:3
130:23 131:3,6	prints 230:13	proceed 5:19	293:8,10,14,19
133:5,16 135:7	prior 30:7,8	6:4 25:23	294:4
135:9,12,16,16	39:23 63:5,8	245:10	processed
136:2,15,16,20	63:20,22 69:12	proceeding 5:7	172:16
136:22 137:2,4	70:15 214:4	proceedings	processes 83:20
137:6,12 138:7	239:13 241:11	261:6 296:19	88:24 167:23
141:24 142:1,7	245:22 247:3,9	process 24:11	172:3,11,14,15
142:8,21,22	247:13 250:21	30:20 31:21,23	172:23 173:17
143:2,5,12,15	251:8 252:7	31:24,25 38:23	244:9
143:25 144:11	253:2,8 254:9	48:3 82:13,20	processing
145:3,9,10	259:16 275:2	83:23 89:4	124:14 126:8
149:14 150:4,6	277:11,13,19	114:17 126:6	151:9,16
150:19 151:20	277:22 297:13	130:25 131:8	172:19 210:2
152:6,13,18,22	prioritize 28:18	133:16,17	210:18 211:6
153:3,9,20,24	priority 141:20	151:14 153:14	211:13 212:8
154:9,21,22	privilege	153:15,20,21	212:14 221:23
207:19 213:12	239:21 263:13	163:13 167:10	236:2
216:21 217:4	privileged	168:2,11 172:1	producing
220:10 223:5	53:25 55:19	172:2,6,8,8,21	206:12
229:6 230:11	129:23	172:22 173:11	product 9:17
230:12,13,16	prize 69:9	174:6,12	9:19,22,24
230:18 247:8	probably 23:15	197:19,21,24	10:2 11:12
247:14,19,20	69:8 123:25	198:15 202:8	15:25 16:3
248:3,4 252:1	150:17 197:12	203:23 204:16	17:14,20 47:24
252:19,23	202:22 215:4	210:1,22	54:1 82:25

[product - proud]

83:3 84:5 114:21 118:4 120:14,15 157:15,17,22 159:12 160:17 221:12,15 239:21 261:16 261:17,19,22 production 3:15 11:11 34:15 40:3 67:22 84:11,11 86:19 92:16 104:15 132:9 135:24,25 143:13,15 148:10 153:10 166:4,11,15,17 166:18 219:23 223:15 226:20 231:2 235:16 266:25 269:18 270:3 products 69:22 70:21 81:13 95:18,19 96:2 105:4 119:9 122:1 157:18 157:19,21,24 158:4 166:4 220:15,16 260:25 265:8 270:8,16 284:19,24 285:1 293:9	professor 133:6 profile 23:16 program 13:2 14:3,14,15 15:9,20,24 18:14 22:6 33:1 34:16,21 45:3 46:8 47:13 48:14,24 50:18 51:6,14 51:19,24 111:18 112:22 112:23,24 113:2,6,9 114:24 116:12 116:19 117:7,9 117:17 118:1 118:18,20 121:4,11 254:10 255:12 programs 220:9 progress 3:13 59:17 116:11 116:18 268:13 progressed 225:8 project 13:10 13:12,14 14:7 14:11,22 78:9 114:20 218:10 218:17 219:21 220:4,13,24,24 223:6,9	projects 220:12 220:25 221:2 221:10 222:23 224:9 promoted 10:2 prone 173:12 pronounced 20:23 proof 44:7 65:23 142:25 propagates 167:16 propensity 291:13 proper 58:5 294:10 properly 26:17 27:22 70:20 93:17 173:4 264:16 294:10 properties 45:21 76:22 84:3 108:22 260:11 272:6 288:21 289:18 291:10 property 86:3 259:23 261:10 261:24 264:18 272:13,18,25 272:25 273:2,4 273:23 proposal 31:9 48:17 49:6,7 117:19 135:5	proposals 216:24 propose 46:25 253:23,25 258:4 proposed 39:25 41:12,13,17,21 42:9 43:15 49:5 65:2 68:20,24 207:18 217:10 237:23 238:24 247:17 279:4 proposing 47:8 53:1 207:3,8 210:1 217:1 241:18 253:21 286:1,23 proposition 135:6 protect 43:6 211:2 212:2 227:21 230:4 238:6 252:3 protected 156:2 protecting 211:14,14 213:4 233:17 236:3,4 242:18 242:19 protocols 159:19 proud 120:14
--	--	--	---

[proven - quantum]

proven 135:23 provide 13:13 22:2 27:20 28:5 55:18 81:3 103:25 123:5,11,14 168:20 169:4 169:16 170:15 228:21 294:15 provided 56:18 80:12,14,17,24 122:13 130:4 147:13 169:11 288:17 299:19 300:8 providers 17:1 provides 76:1 136:2 173:2 providing 141:14 168:16 public 18:21 20:11 36:9 43:24 44:1 46:13 94:1 95:17 211:8 217:12 259:17 265:23 publication 119:8 publications 271:18 279:7 publicized 44:24 publicly 128:23 129:12	published 292:20 pulling 46:9 purchase 262:23 purchased 45:1 purchasing 141:13 purple 109:20 purpose 51:15 51:23 purposes 115:8 pursue 62:25 63:10 117:20 255:15 pursued 255:11 pursuing 62:18 64:18 92:13 212:18 240:4 push 24:16 84:10,21 97:6 115:22 140:2 pushing 128:18 put 15:3 41:2 76:6 101:9 114:15 119:10 125:4 140:6 151:18 153:5 155:1,6,21 161:10 164:6 164:11 173:25 174:1,8 198:11 205:23 207:10 207:10 229:18 278:2 282:7	291:5 puts 140:18 173:22 putting 7:6 39:25 114:19 130:16,19 174:3 195:6 239:9 295:12 q qd 67:6,18 68:5 68:8,11,13 69:12 89:9,10 89:11,18,24 90:6,13,15 91:6,15 92:19 92:25 93:12,21 94:10 95:25 96:2,9,11,18 97:11 98:12 100:2,7 266:5 266:18 295:8 295:16,23 qds 91:1 qleds 267:3 qualifications 157:18 qualified 78:1 112:21 qualify 114:17 117:13 142:16 142:17 159:12 160:17 qualifying 157:17	qualitative 294:19 qualitatively 278:24 quality 4:9,10 11:23 12:1,6 24:7 114:15 255:2 269:4 quantification 123:20 124:10 124:17 quantified 124:4 quantify 122:4 122:22 123:14 123:25 quantitative 98:2 278:23 293:18,23 294:19,20 295:3 quantitatively 107:17 quantum 67:21 67:22,24 68:13 68:15,17 69:5 69:6,9 72:23 73:2,5,9 89:15 92:14 93:15,21 96:11 160:23 161:2,4,16,18 161:23 162:1 162:13,20 170:13 255:14 255:16,17
--	---	---	--

[quantum - reasons]

265:25 266:4 266:17,24,25 267:2,6,10 285:7,12,19 286:7 quenching 178:12,13 question 8:10 8:13,16 18:1 37:16 46:21 54:6 57:1,1,13 57:15 61:15 66:12 74:2,18 80:7 82:2 85:12 89:8 90:4 92:3 122:9 136:21 139:18 142:24 156:21 159:6 168:16 172:6 173:1 179:20 191:13 211:2 214:8 217:11 241:4 246:20 250:4 263:7,9 267:19 268:1,6 271:8 272:16 280:3,6 284:21 questions 65:4 249:16 287:15 287:18 296:7 quick 30:4 quinn 2:13 5:14 6:15	quinnemanue... 2:16 quinolate 175:17,21 177:10 271:2 271:10,12 290:18 quinolates 177:11 quite 29:9 57:9 57:11 164:16 281:22 quoted 101:15 r r&d 11:7,12 17:15 22:6 29:1 33:5 34:16,19,20 36:24 83:19 84:9 114:20 120:16 220:8 221:10,16 223:6 231:8 233:3 r&s 300:1,9 r2r 228:6,7 raise 258:15 raised 237:1 raising 132:22 range 25:6 120:6 rare 254:13 rate 28:19 34:20 124:1 137:11	rather 24:18 45:8 115:23 127:5 143:9 151:11 176:10 raul 118:12 react 37:19 read 8:1 20:10 53:12 58:21 60:3 68:7 69:24 70:5,12 72:11 105:24 106:2 120:22 125:3 138:15 164:9 190:21 199:11,13,20 199:22 200:6 200:10,15,24 201:4 202:14 206:22,24 208:11,15,25 217:20 236:23 237:13,20 242:12 284:4 284:13,16 readiness 223:2 reading 18:20 67:7 79:10 88:14 97:2 99:25 143:7 146:23 175:14 176:17 200:5 211:5 216:4 219:10 237:19 238:19 241:9 270:12 299:24	300:9 ready 40:5 55:22 84:21 170:1,2 219:23 223:16 224:16 real 109:8 224:17 realize 50:9 263:25 realized 98:20 really 36:8 61:8 61:25 69:6 93:20 94:4 96:14 100:22 109:7 114:13 114:17 120:15 144:21 160:15 167:15 171:17 205:19 226:12 231:9,9 259:2 271:22 275:13 291:22 294:18 rear 108:7 reason 14:17 29:16 34:7 51:13 93:9 112:21 143:14 169:14 175:16 209:21 222:6 reasonable 203:13 reasons 107:22 113:1 259:3 295:2
---	--	---	---

[rebuttal - related]

rebuttal 139:21 217:18	recollecting 217:9	142:1,4 144:15 168:24 237:2	refreshing 240:20
rebutting 139:15	recollection 42:22 127:18	270:16,22	regarding 60:23 61:1,4
rec 107:9 109:3	196:15 210:21	reduce 210:2 211:6,12	65:11 66:12
recall 6:16	recombination 75:22,23	217:22 228:3 248:18 249:2	86:9 96:16
24:13 29:16,25 31:11 41:6,12 52:21 55:7,20 55:24 58:6 155:21 159:20 197:8 222:23 231:25 232:23 233:5 268:18 280:21,25 285:9	recombine 173:8	reduced 279:5	regardless 251:13
receive 25:25 76:24 112:7,17	recommend 25:17	reducing 40:3 204:3 236:2	regions 209:24 215:23 226:25
received 133:21	recommendat... 28:17	refer 65:18 155:16 225:24	regular 26:2 198:11
receives 75:21	record 4:6,15 5:10 6:8 52:8 52:11,14 111:8 111:10,14 112:9,12 134:13 163:4,5 163:9 182:20 231:14,20 296:3,13,17	reference 125:24 240:12 246:9 247:15 280:25	regularly 197:25
recent 152:8 270:13	recorded 4:13 4:17	referenced 200:1 299:6	relate 293:9
recently 53:18 67:3 106:25 237:6 239:8,11 247:7 265:13 268:8	recording 4:9 4:14	referred 118:17	related 5:4 32:22 33:11 45:20 49:15 60:20 61:9 62:3,4 67:6,8 67:19 68:9,10 74:18 81:4 83:6 86:18 87:7,21 88:16 88:19 90:10 95:8 96:17 112:20 115:6,6 140:10,17 149:10 160:24 161:1,2,8,11,15 167:18 168:7 169:7,7,14 245:2 249:11 250:1 290:3 297:21
recess 52:12 111:12 112:11 163:7 231:18	recovered 247:7	referring 16:14 18:2 36:10 38:22 75:7,10 75:17 78:7 95:13 106:5 124:21 170:25 203:8 230:25 233:15 271:5	
recipe 68:11	red 13:24 45:10 45:11 49:3,24 50:24 67:11,23 84:13 87:9 88:20 89:15 98:8 99:19 113:13 119:14	refers 202:10 202:16 228:7	
recognize 150:10		reflection 108:7 110:11	
		refresh 70:23 100:12 104:12 116:4 131:25 148:6 182:7,10	

[relation - report]

relation 60:21 61:10 78:8 82:4 117:12 123:20 127:12 290:21,25 292:19	54:7,9 55:11 55:16,25 56:24 58:7,13 63:19 64:14,14 68:23 69:2 72:6 86:5 86:12 98:1	265:17,17,19 277:4 280:14 280:15,17,22 281:3 286:21 286:22	replacing 107:1 108:1
relations 16:25 74:1	99:11 104:3 109:13 118:21	remind 57:10	report 3:10,13 44:25 46:13 53:19,22 54:4 60:21 61:10 65:8 78:3,6,7 78:15 79:3,7,8 79:14,23 80:4 85:20 86:9,15 86:25 88:18 89:14 94:25 97:2 98:18,24 101:10,16 104:18 105:2,4 116:11,15,17 116:18,25 117:4,5 119:18 121:19,21 122:6,19 123:1 123:18 124:12 125:3 126:6 127:18,20 128:3,5,12,20 138:11,16 139:14,20,21 139:23 140:8 140:17 141:11 143:7 155:22 159:24 163:12 163:14,21 164:11,15 165:21,23 166:22 175:14 241:9 256:1
relationship 35:9 162:20 250:7 265:21	120:24 123:17 123:19,24 141:9,17 146:23 148:16 149:17 155:20 164:4 176:8,15 176:17 184:16 185:7,8,10 186:20 188:10 188:11 189:10 192:12 195:6 197:11,14,18 197:20 198:13 198:20 199:6 211:5 212:25 213:25 223:3 223:11 227:1 227:13 231:25 232:10,20 233:1,9 234:16 234:22,24 235:3,25 237:9 238:2,15,19 247:10 251:25 253:11,23 254:8 255:1,22 255:23 259:15	remote 59:7 134:6 remotely 2:2 5:1 115:6 161:1 185:8 removal 229:13 remove 212:11 render 121:3 rendering 67:9 67:16 68:2 93:17 99:23 114:4 repeat 46:21 61:15 72:17 74:2 82:1,4 122:8 164:20 180:25 209:20 251:1 271:8 280:5 repeated 123:20 repeating 116:16 replace 108:19 110:12 replacement 110:23 replaces 110:18	

[report - reviews]

263:23 277:3 278:5 292:12 293:18 294:14 295:23 reported 1:23 93:13 297:9 reporter 2:4 5:17,20,22 7:5 37:6 92:2 101:23 112:8 134:1 231:17 261:3 280:4 297:1,7 reporters 93:12 reports 60:3 80:5 88:14 95:14 140:6 147:8 149:1 155:20 163:15 163:18 176:18 176:24 represent 165:6 representing 5:2,13 request 80:22 requested 57:25 297:23 297:25 300:1,9 300:10 require 207:9 required 34:2 45:13 260:2 264:21 299:20	requirement 29:12 249:1,6 requirements 290:8,10,14 requires 142:7 210:17,18 226:10 rescheduled 56:17 58:1,12 research 11:4 112:17 researchers 254:3 resident 35:20 residing 23:25 resolution 90:22,25 91:24 93:4,7 96:21 97:5 99:15 140:19,21 resolutions 92:9 97:17 respect 30:8 107:9 127:15 127:16 227:19 272:3,5,12 273:15 respected 260:10 respectively 78:18 respond 7:16 8:10,14 92:5 responding 140:5	response 117:8 202:25 responsibilities 32:9,15 responsibility 9:15,25 10:4 11:6 16:4,7 32:1 117:9 responsible 16:12 117:11 118:3,5,7 rest 35:5 121:14 189:21 result 98:16 102:20 120:16 294:22 resultant 50:24 resulting 110:6 results 124:4 130:6 resume 23:16 retained 6:10 6:13,14,22,23 6:24 7:1,9 52:18 54:18,20 58:20 296:16 retardation 109:11,19 110:1,14,19 return 299:17 300:6 returned 262:11 reveal 7:14 55:14 56:8	165:15 239:19 revealed 97:2 reverse 273:11 review 7:19,24 26:13,19 28:5 52:18 58:19 70:4 80:16 89:24 124:8 133:18 134:19 147:17 163:14 163:20 185:4 185:13 232:5 232:18 286:23 297:23,24,25 299:8,10,13 300:2 reviewed 7:25 31:5 54:22 62:9 65:13 66:14 79:22 80:3,4,7,14,18 81:9 83:6,10 93:6 96:6 122:16 127:21 148:20 163:17 164:19 185:11 235:24 283:25 284:1 292:12 292:15 reviewing 122:25 165:11 200:13 232:23 240:10 reviews 72:20
---	--	--	---

[revolve - samsung]

revolve 237:23	62:19 65:4	188:22 192:10	robust 49:22
revolves 85:21	66:4 72:12	193:1,2 194:5	rochester 10:13
274:24	77:3,9,25	195:5 196:21	role 9:15,23
revolving 140:1	81:23 82:9,22	198:9 200:7,22	10:2 30:22
rgb 14:2 46:11	84:18,25 85:21	209:25 210:3	76:3 93:16
49:8 50:4,22	89:2,6 90:19	210:20 212:4	97:19 117:16
51:10,17,21	92:11,14,22	213:13 214:4	239:22 290:23
67:10 84:23	98:14 99:6,17	214:12,18	roll 33:19
88:25 89:9	99:21,24	215:4,6,15	209:1 224:4,4
90:1,5 91:4,20	100:16 101:1,5	216:14,19	224:10,10,12
93:7 94:20	103:7,23 107:9	221:25 222:14	224:12,19,20
95:15 96:6,16	111:4 118:15	225:14,21	226:22,22
97:9 100:8	119:23 120:13	226:7,9 227:10	228:7,7 229:5
103:10 104:7	124:19,20,25	228:19 233:20	229:5,6,6,12,12
106:17 108:2	125:12 128:15	234:10 237:22	230:9,9 231:1
113:24 114:3,8	128:18 129:18	240:2,9,12,14	231:1,5,5
114:15,16,20	131:2 135:7,9	244:3 245:4,11	room 156:18
114:24 115:2	135:14,24	246:8 247:24	157:5,13,25
115:21 120:3	136:8,16,18,20	248:16 252:15	158:20 159:16
134:25 135:1	136:21 137:19	253:3,6 258:13	roughly 25:10
135:17,23	137:23 140:22	262:16 263:16	rule 179:2
141:6,12 143:3	142:18 153:24	267:18 272:9	252:16
143:16 145:3	155:18 157:22	274:2,18,24	rules 57:3,12
169:2 170:2	159:20 161:10	275:1 287:9	300:8
220:11 294:6	161:21 162:11	290:19 294:25	rumors 94:13
294:11,25	162:18 167:17	295:3 296:3	running 51:3
295:7,16,19,21	168:19 169:2	rights 262:18	rush 134:15
rheological	171:10,13,14	272:18 273:1	s
45:20	171:24,25	rigid 224:7	s 3:5
rid 166:9	173:18 174:4	225:3,4	sagging 102:21
right 6:23 21:4	175:21 176:16	risk 51:3	samples 289:7
21:12,14 27:24	177:18 179:2	rmr 1:23	samsung 1:7,8
42:23 46:6	179:18 180:6	road 221:4	3:16 4:20 6:11
47:1,9 51:12	183:9 185:3,15	roadmap 13:1	6:15 7:10,15
55:24 58:7	186:10 188:8	34:19	18:12 54:17

[samsung - seconds]

55:2,5 58:20	292:19,19,24	scalable 92:10	sd 1:25
61:10 78:8	293:15 299:4	scale 12:22	sdc 3:10,10,12
79:11,17,21,22	samsung's	19:21,23	3:12,17,17
80:7,13,17,21	81:11,20 92:19	scan 189:23	100:14 104:14
83:3 88:23	110:11 122:1	scanning 190:6	104:15 124:22
90:10,11 93:11	143:8 266:5	scattered 196:6	140:2 148:11
94:15 95:6,14	267:14 268:3	schedule	164:24 165:2
96:20 97:3	269:4,23 270:7	299:10	se 17:8 45:24
98:4 99:7,18	271:23 277:7	scheduled 55:8	81:13 98:12
100:5 103:14	284:18	197:25	115:18 128:9
103:25 106:25	san 11:1 17:15	scheme 286:24	sealed 299:20
108:8 126:2	29:4,4 48:9	school 236:20	search 63:22
128:1,20,21	222:18 248:21	science 53:8	searching
129:14 130:9	save 108:9,19	scientific 37:15	247:13
130:12 138:10	212:9	103:22	seattle 2:15
138:18 139:9	savings 107:22	scientist 21:6	39:14
143:22 145:1	107:23 110:24	224:4 249:11	second 13:23
146:16,20	212:8	249:20,25	14:16 20:7
148:9 155:19	saw 173:23	screen 4:12	32:6 38:20
156:2 165:4	175:25 196:23	135:16 230:17	56:25 76:20
169:4 225:10	238:21 256:17	253:14	88:6 89:20
225:23 250:8	284:25	screens 91:22	105:22 106:8
250:17 263:11	saying 62:22	screwing	110:4 126:24
263:12,18,22	142:20 162:5	144:18	134:2 149:6
264:16,24	172:6 186:8	scribe 205:11	165:14 193:7
265:6,16,20,23	217:2 236:12	205:12 208:20	200:3 206:16
266:13,18	257:1 277:12	210:7 238:13	208:16,22
267:4 268:7,9	says 125:24	239:2 279:14	228:14,18
268:15,15,21	183:20 184:22	scrip 170:23	229:10 234:25
269:15 270:2	186:8 196:7	script 167:13	241:3,4,21
271:6 273:22	202:1 209:1	170:21	261:3
273:23 274:10	216:20 235:4	scripts 168:21	secondary
274:16,21	246:8	scroll 187:7	219:18 220:12
275:19 276:2	scalability	188:13	seconds 147:5
278:5,6 284:25	137:18		181:24

[secret - set]

secret 24:10 25:18 124:15 section 119:20 120:1 secure 259:3 see 25:23 39:23 41:20 47:22 50:22 51:16,20 64:18 68:20 70:24,24 73:19 77:11 80:23 97:1 98:25 100:13,13,18 100:18,21 101:5,7,8,20,25 102:6 104:13 104:13 105:15 106:14 107:10 108:6 109:15 109:18 116:5,5 116:6 117:23 118:6,9,16 120:11 124:19 125:10,11,13 127:7,25 132:1 132:10 134:13 134:22 139:22 146:22 147:16 148:12 149:9 149:13,19,22 149:25 150:3,4 150:10 156:12 182:3,8,8,16 183:11,15 186:14 190:5,6	190:6 191:11 191:18,19 192:1,17 195:22 198:6 199:14,24 201:7,19,23 202:7 203:4 206:14 207:12 209:5,13 215:14 223:6 223:22 233:15 233:25 234:4 234:11 238:20 239:14 244:4 245:1,17,23 246:11 247:12 248:22 265:5 274:7 284:6 293:7 seeing 104:3 106:1 123:18 149:18 212:25 233:9,13 255:23 277:4 seems 186:8 187:8 188:10 seen 4:12 24:11 47:7 76:10 87:2,3 95:22 104:2,25 148:15 149:3 149:16,23 155:8,19 156:1 156:1,23,23,24 158:1 176:6,11	189:17 201:6 233:10 239:8 256:21 263:21 263:24 271:18 279:19,21,23 293:12,14 selected 204:11 207:5 selection 168:13 169:22 170:5,5 288:4 selective 126:23 127:2 127:12,19 203:18,24 208:20 209:9 212:9,20 230:15 238:12 selectively 208:6 226:24 275:21 sell 261:22 282:6 selling 261:19 283:16 semiconductor 212:21 semiconduct... 212:24 213:4 semiquantitat... 294:3 send 133:23,24 senior 10:18 24:21 222:24	sense 26:24 43:14 98:9 135:2 152:4 153:13 167:24 198:10 294:17 sensitive 173:9 238:8 sensors 214:16 226:7 sent 35:16 sentence 73:15 74:9 82:4 206:22 208:16 sentences 74:19 separate 16:22 50:23 256:19 separately 287:8 september 10:12 20:2 189:3 234:7,12 sequential 172:19 serious 218:12 218:23 seriously 136:5 session 52:17 60:20 61:9 232:2 set 40:6 57:18 81:16,23 82:9 82:12,22 83:11 249:14,19 298:1
---	--	--	--

[seth - size]

seth 139:4	148:1 155:17	192:5,6,8,13,15	188:11 232:10
sets 169:12	191:6 197:3	192:18,20,21	silenced 284:24
271:23	showed 285:10	192:24,25	silicon 131:11
seven 287:3,12	showing 262:8	193:5,9,10,13	169:16,20
296:5	shows 105:12	193:16,25	226:2,3 276:17
several 220:25	shutting 31:20	194:4,9,13,16	silicones 77:13
sfe 196:3	shy 263:24	194:19,22	similar 22:19
shadow 87:14	side 41:14,15	195:2,13 234:9	46:2 70:15
206:11 207:16	56:19 102:1	297:23,24,25	214:22 233:10
226:5 293:24	109:6,6,20	298:6 299:22	241:25 242:1
shape 98:20	124:19,25	299:24,24	243:13 256:21
share 70:23	125:13 135:22	300:9	similarity
100:13,19	135:24 186:23	signature's	256:10 257:4
104:13 116:5	192:23 193:1,2	189:16	simple 158:21
132:1 134:25	194:14 215:15	signatures	162:23
148:6 182:8	246:11	184:5 190:3,4	simply 59:18
269:18,23,24	sides 145:23	190:16 191:20	single 13:20
shared 54:17	279:18	191:23 193:20	49:21 87:23
103:21 128:24	siemens 24:1	194:3 195:7,12	89:5,11 103:4
232:8 278:6	35:10,12,12,14	232:11	103:13,19
286:8	35:16,18,21,23	signed 62:10	104:4 113:22
sharing 170:18	35:24	64:9 185:5	119:1 162:7,24
269:17	sign 28:8,11	188:21,24	176:3 212:21
shirts 230:13	31:4 64:15,16	192:2 195:10	sir 6:7,10
shock 159:14	116:21 197:3	195:18 231:24	sit 196:23
shooter 244:13	299:16 300:5	232:4,4,6,14,24	sitting 23:9
shorten 180:17	signature 29:11	234:6	situation
180:18	62:17 182:16	significance	170:12 181:25
shorter 145:7	182:18,19,23	30:12	182:3
145:17,19	183:17,17,18	significant	six 24:24 30:6
146:2	184:9,14,16	125:22 143:8	85:4 199:1
shorthand	186:22,24	significantly	296:15
297:16,19	188:23 189:6	269:25	sixth 206:20
show 84:15	189:17 190:17	signing 30:13	size 49:15
114:19 120:18	191:19,23,25	30:13 31:6	90:20,21 228:4

[sizes - spin]

sizes 146:9 skeptical 93:10 skill 70:8 249:14,19 skilled 68:6 slam 218:13 slash 151:10 slides 149:23 slight 292:21 slightly 66:11 80:6 111:3 170:14 184:4 slow 43:19 89:4 200:14 small 19:23 21:3 34:17 44:15 49:14 91:22 206:12 231:9 289:5 smaller 44:8 146:3 156:24 solar 59:21,21 sold 16:16 251:22 solid 36:4 77:10 133:8,10 solids 38:1 soluble 10:19 11:15,20 12:9 12:14,19 13:18 17:22 18:7,24 21:11 34:24 36:13 44:18,21 48:8 118:24 204:5 238:8	244:7 252:4 259:7,18 260:23 solution 37:19 87:10 111:23 112:2 202:4 204:16 solutions 5:3 13:5 296:16 299:7 solved 128:4 174:5 solvent 37:20 solvents 37:24 someone's 272:17,17 something's 163:23 soon 24:3 sooner 24:18 sorry 14:13 15:22 21:14 22:9 39:10 42:19 54:19 58:18 59:11 61:15 77:9,14 80:6 82:2 92:4 101:6 109:15 116:14,16 119:21,24 129:3 133:11 140:12,13,13 163:24 164:1 170:9 181:4 188:4 192:7,7	205:4 211:18 213:17 216:9 222:7 227:10 250:25 290:11 sort 60:6 65:9 151:22 213:4 228:22 256:10 sound 86:13 sounds 231:13 239:6 source 46:11 49:9,12,21,23 51:2 85:9,16 85:16,19,19,23 85:24 99:2 113:10 114:4 137:20 sources 48:18 50:3 67:8 space 65:21 69:25 70:16 132:19 138:6 215:7 227:2 242:21 270:24 speak 26:15 138:10,13,17 138:23 139:10 260:15,19,22 264:3 speaking 25:10 57:6 spearheaded 266:24 specializing 32:3	specific 42:15 43:2 65:14,15 65:17 74:3 80:7,11 85:12 127:19 135:8 145:4 168:16 214:14,22 263:9 267:19 specifically 67:11 93:6 95:8 100:24 122:18 207:25 284:23 285:11 293:9 specifics 267:22 268:12 268:25 specify 267:18 spectroscopy 150:8 speculate 150:14 191:10 244:10 251:6 266:11,12 speculating 150:12 speculation 200:4 202:13 243:18 spend 59:18 221:14 spent 47:18 164:5 218:20 spin 11:22 45:12 140:16
--	--	--	--

[spin - strike]

202:10,16,18 202:22 203:3,8 203:18,23 204:4,9,13,15 205:7,18 206:2 209:1 210:19 spinning 202:3 202:10,16,19 202:21 203:7 204:24 spinout 41:12 spoke 256:15 spoken 139:3,4 139:12 spots 156:13 spring 6:21 23:6,8,11,12 54:18,20 234:13,19 sputtering 202:6 square 196:7 ss 297:3 ssl 3:15 132:9 133:7 stability 168:20 stable 155:23 stack 43:16 82:10 83:12 85:10,11 139:10 171:8 174:13,23 177:4 289:16 stage 85:9 258:14 261:15	stages 41:6 stand 102:8 133:7 standalone 189:11 standard 159:20 212:20 212:22 287:1 standards 160:6 stars 2:9 start 22:6 38:25 54:3 201:14 259:16 started 9:5,6,10 10:10 23:3,4 36:6 42:6 44:4 47:13 54:15 140:25 146:17 165:10 210:25 234:13 268:7,8 268:15 starting 73:16 190:18 206:19 206:20 starts 86:21 261:21 startup 42:2 59:20 228:25 258:3,13,14 startups 73:6 state 2:4 5:7,9 5:22 6:8 31:1 61:13,18 77:10 133:8,10 297:2	297:8 298:3 299:9,12 stated 52:16 245:18 246:25 247:13 255:19 statement 246:2 268:11 states 1:1 4:22 146:22 static 162:10 stating 257:11 statistical 294:4 stay 12:11 59:16 236:9 stayed 60:4 121:15 stealing 240:17 stencil 230:2,17 253:15 stencils 252:3 step 62:19 124:14 126:8 136:18,18 204:3,17,18 207:23,23 213:9 214:18 214:18 220:7 steps 207:22 210:2,18 211:6 211:13 212:15 221:23 236:2 236:11 stern 133:6,6	steven 133:1 stick 209:5 sticking 126:14 stipulation 299:21 stop 91:25 220:20 story 72:7 straight 189:9 244:1,13 straightforward 162:19 strategy 117:19 strength 66:9 66:10 252:14 stress 126:12 160:8 168:22 173:22 stressed 202:2 stressful 220:16 strike 9:5 10:7 11:2 15:20 22:13 44:19 69:14 71:23 74:5 78:3 97:22 108:13 123:11 124:14 129:4 140:14 140:24 152:11 163:12 167:4 177:2 259:11 265:15 266:2 269:21 271:11 272:3 278:14
--	---	--	---

[strike - sure]

279:22 stripe 148:1 striped 114:4 stripes 13:25 46:11 49:3,8 114:8,16,20,25 115:2,8,10 119:15 strong 15:15 131:14 176:9 258:7,9 282:18 structural 196:8 290:8,14 structure 36:14 90:5 110:20 135:3 173:15 201:3,22 227:16 290:12 290:21 structures 53:8 70:14 89:9 126:9 179:5 207:25 227:16 286:19 289:5,9 struggled 41:7 struggling 40:10 student 255:1 students 254:20 studies 263:21 study 152:12 stuff 41:25 46:13 121:16 147:3 154:20	164:10 189:9 230:13 240:11 282:6 292:9 subject 201:1 submit 63:21 submitted 25:21,22 117:18 121:19 139:14,20 182:22 196:17 253:2 submitting 24:14 subpixel 90:5 91:21 295:17 subpixels 87:9 90:1 93:7 104:8 subsequent 53:19 72:7 202:5,15 subset 122:19 171:25 subsidiary 35:12 substantial 14:3 substrate 34:1 34:9 44:6,8,14 88:21 118:15 124:12 126:15 137:20,22 146:7 167:19 168:3 170:1 174:2 220:10	224:8 225:3,5 226:4,16 230:4 substrates 12:22 19:17,23 19:24 42:12 44:16 48:13 59:21,22 102:20 119:5,6 119:8 226:1,2 230:19 subtractive 207:22 success 79:17 successful 37:9 132:21 147:11 270:5 273:10 successfully 38:7,14 92:16 suggested 208:5 288:24 suggesting 64:1 209:8,12 289:9 suite 2:9,14 sullivan 2:13 summer 121:15 summers 254:19 super 42:20 supercapacitor 227:15 supercapacit... 42:11 227:11 superior 143:5 197:13	supplier 60:2 282:14,15,24 suppliers 266:14 282:13 283:9,14 supplies 119:11 266:2,4 support 221:5 supported 51:7 51:14 supposed 151:20 287:7 sure 26:16 30:18 31:8 38:12 43:1 46:5,23 59:12 64:18 94:10 111:2 112:10 117:25,25 120:23 122:12 128:20 133:19 134:14 141:10 142:14 144:4 147:6 148:22 151:3 163:3 164:22 166:20 171:17,20 176:6,8 181:7 187:4 188:6 190:2 199:12 200:15 209:17 228:24 230:19 235:12 243:21 260:24 261:5 276:11 285:4
---	---	---	--

[sure - technologies]

294:4 295:11 surface 205:9 surfaces 11:20 surprise 143:21 surprised 173:24 233:14 suspect 276:12 swath 285:12 switching 152:5 sworn 5:25 297:14 synonym 76:8 synonymous 76:8 synthesis 266:24 synthetic 289:11 system 82:25 89:3 154:2 systems 87:10 167:18	52:3,5 56:21 57:23 66:25 78:13,23 80:21 100:17 111:5 135:21 139:25 148:7 149:21 149:22 159:23 163:2,20 168:25 177:13 195:16 199:9 200:16 204:21 210:21 214:1,8 224:6,21 227:6 227:23 228:13 231:11 245:12 264:7 267:19 taken 4:18 12:16 264:6 takes 16:17 26:20 40:4 211:24 talk 40:1 56:9 60:3 88:9,12 98:11,12 101:23 109:16 121:18 127:19 128:4,6 130:1 147:3 202:21 224:22 253:4 292:23 talked 128:12 131:14 235:12 talking 18:4 39:11 44:1 91:25 96:4	127:9 135:22 141:5 142:1 147:7,8 173:21 179:24 180:1 202:22 203:7 207:25 211:1 211:21,22 216:14 219:11 224:1 225:1 233:19 253:5 255:17 257:3 283:4 talks 87:14 124:12 127:21 134:25 140:20 294:20 tape 207:10 210:20 tapes 210:18 targeted 127:5 205:19 279:13 targeting 172:23 174:9 174:13 task 45:8,9 118:2,6,9,9,12 118:13,14,23 119:4,9,13 tasked 32:20 tasks 7:18 52:17 118:2,21 118:22 teaching 67:18 team 3:10 9:18 9:22 10:25	11:7 16:10,23 16:23 19:20 24:6,17,21,22 25:13,25 26:25 28:18,23,25 29:1 63:6,20 63:22 80:21 118:5,8 119:1 121:15 198:7 210:1 221:16 246:20 254:3 teams 83:22,22 83:23 tech 50:5 technical 3:13 26:10 61:4 62:7 116:11,18 132:23 technically 117:15 118:7 technique 11:22 33:3 36:7 40:11,12 123:6,15 126:21,23 146:18 152:18 203:19,20 212:9,10 254:1 techniques 19:12,14,14 41:11 122:5,23 152:14 166:2 207:21 280:17 technologies 10:21 19:19
t			
t 3:5 230:13 t98 125:19,20 125:20 tablet 95:4 tablets 90:23 91:18,22 93:8 95:9,10,22 96:7 270:15 tail 16:21 take 4:14 8:21 43:20 45:15			

[technologies - tfe]

20:14 33:6	153:25 154:3	238:11 248:10	terms 76:10
41:21 42:10	165:7 166:22	288:15,20	179:20 269:7
45:25 46:1	167:5,6,7	291:24 292:2	285:24
48:8 51:6	169:3 170:7	telling 36:20	test 156:17
196:4 213:13	211:7 212:20	156:14 159:25	157:4,9,25
260:3 264:12	213:19 214:6	tells 294:5	158:3,7 159:9
266:15	214:11,20	temperature	160:8,14,16,19
technology	217:11 224:7	128:6 156:18	222:5 223:23
3:10,11,15 5:1	225:9 229:1	157:5,13,13,19	tested 245:18
7:3,10 9:7 12:9	230:11 235:12	157:20,25	testified 6:2
12:15 18:13,24	235:18 237:9	158:3,8,19,20	testify 5:25
19:4,9 21:10	240:3,8 247:20	159:14,16,17	297:14
37:2 39:8,18	248:18 259:19	160:10 166:12	testimony
39:19 42:2,13	260:1,2,12	166:14 169:15	52:21 75:10
42:17 44:22	261:12 262:10	temperatures	testing 10:1
45:7,24 48:20	262:14,25	40:22 157:4	157:16,20
50:4,16,19	263:13,20,25	159:10	158:2,9,11
60:8 65:22	266:14,17	tend 177:11,12	160:7,11
66:2 90:15	267:14 268:3	178:23 270:16	220:19 222:5
91:5 92:8 94:9	268:16 270:7	tends 37:19	tests 126:12,13
94:11 95:4,16	273:10,24	177:19 178:10	158:17 159:13
96:23 97:6,8,9	274:22 279:8	tenure 199:4	159:14,15,18
97:22,24 98:4	280:20 281:1	term 73:19	159:20 160:11
99:10,13 100:6	283:20 284:15	74:22 75:12	texas 1:2 4:23
105:20 106:6	288:1 294:8	76:2 77:2	57:3
106:17,21,24	295:2,5,13,19	101:19 102:11	tfe 134:24,24
107:16,21	295:19,23	104:5 116:2	135:6 136:1,22
108:16,16,24	technologywi...	144:17 146:25	142:3,7,15,18
110:18 115:22	8:22	218:17 265:25	142:21 143:2
116:2 118:24	tell 62:6 65:3	terminate	144:20 145:5
123:8 132:8,22	117:24 177:6	14:16	145:20 146:17
138:8 140:3	188:9 191:7	terminated	149:9,14 151:8
142:3,5,8,21,23	193:3 197:12	14:24	151:16 152:8
143:9,16,18,24	224:15 228:2	termination	152:22 154:10
144:1 146:21	235:25 237:14	14:18	155:3,22,22,23

[tfe - think]

155:23 156:2,3 156:13,14 172:8 173:13 173:22,25 217:10 228:6 229:5 252:20 tfes 144:21 tft 169:3,6,10 169:15,23 170:7,15 174:7 tfts 168:7 169:25 thank 5:16 52:10 104:16 296:8,9,10 theoretical 121:1 181:25 216:23 theory 37:17 50:7,25 146:10 179:11 230:16 thereof 297:22 298:1 thermally 151:25 thesis 140:4 thicker 135:13 thickness 131:3 145:14 154:15 thin 32:25 33:7 33:8,12,15,17 33:19 34:8,11 38:16 39:3,5 39:15,20,22 40:25 42:7,9	42:16 43:3,12 106:12,20 126:22 127:13 127:21,23 128:2,8 129:9 130:19 131:21 135:15 149:10 166:8 173:13 200:18,19,20 201:2 210:2 211:6,13,16,20 211:24 213:1 213:24 217:12 217:23 218:14 218:21 219:3,9 219:22,24 220:9,23 222:8 223:8,19,23 225:6,14,16 226:3,6,19,22 229:17 233:2 233:16 235:12 235:15 236:10 237:7 238:5,25 239:10,13,15 239:17,25 247:16 248:20 275:4,20 276:4 276:6 277:25 278:7 279:24 281:11,21,23 282:13,16 283:10 286:16 286:17,18,20	thing 45:19 58:9 79:20 87:2,15 89:13 91:23 106:2 115:23 123:24 126:5 146:23 156:14 159:4 162:6,23 168:9 168:25 171:24 179:2 190:21 197:11 201:24 209:5,25 210:25 211:25 213:10 214:8 214:17 215:20 217:23 223:15 226:12 230:3 233:15 240:2 243:8 248:17 249:10 251:18 252:7 258:3 263:24 270:13 273:6 274:19 275:1 284:16 289:14 291:22 295:14 thing's 215:13 things 32:9,20 60:6 73:25 82:8 90:19 111:17 123:18 123:19 148:21 151:6,22 162:12 164:2 171:5 177:7	207:10 213:3 214:7 216:18 217:1 230:23 232:10 239:20 247:23 256:18 260:8 278:3 290:24 291:2 291:11 think 14:9 15:4 15:11 22:23 23:13 32:13 35:7,22 37:1,5 38:11 42:25 44:15 47:7 54:14 55:13 57:20 61:22 63:9,12 66:10 67:4 68:19 69:10 79:5 81:21 86:5,6 86:13,22 97:5 98:2 99:24 100:24 102:10 129:25 146:4 146:25 147:7 147:18 148:3 156:20 157:7 164:7 170:25 171:4 172:25 175:13,24 176:5,6,16 177:17 180:8 183:1 192:4,6 195:10 201:7 202:19 206:19
--	--	---	--

[think - tool]

209:25 211:25	143:4,17 224:9	139:3 141:9	titled 124:25
213:10 214:20	236:24 285:3	149:17 168:22	today 4:7 33:22
215:12 216:20	thoughts	168:23 175:25	37:3,4,8,9 46:2
218:11 223:7	176:16	180:19 198:18	51:11 67:21
233:18 234:22	thousand	199:11,16	68:14 76:16
236:7,11,20	194:10	200:16,21	95:6 135:25
238:4 239:1,5	three 14:15,21	201:7 210:22	140:21 143:13
240:21 243:22	21:17 25:3	211:1,8 212:8	143:15 144:19
244:25 246:25	29:2 54:14	213:23 214:7	153:10 166:11
249:5 255:3	55:4 113:23	217:12 218:1,7	166:15,17,18
261:2,8,10,21	118:12 119:13	218:21 219:5	231:2 271:20
262:13 263:18	121:2 125:11	219:25 220:3	282:5 287:15
264:15 277:3	125:15 131:18	221:15 222:4,5	294:24
278:13,15,24	132:16 144:11	224:10 225:15	today's 38:23
282:21 286:22	160:24 294:6	231:16 232:9	60:19 225:11
286:23 287:2	threw 141:5	234:2 235:2	270:14 281:10
287:14 293:3	throughput	238:16 241:5	together 46:10
293:25 295:10	85:15,21 86:10	242:3,4 245:6	51:3 82:24
thinking	87:4,17,18	247:25 248:5	83:14 110:2
179:20 200:18	88:4 89:1	252:18 253:23	118:25 119:10
211:18 251:17	96:22 123:25	255:18 259:16	159:3 164:11
251:18	126:20 142:10	261:15 267:7	176:17 196:23
thinner 34:8	152:5 153:2,13	275:5 287:5	247:23 291:6
third 30:17,18	212:8	296:2,8,18	told 56:14
260:10 261:9	throw 109:2	299:10,18,25	138:21 233:18
272:3,24	throwing 144:6	300:7	240:6
thirds 15:4,5	tiles 120:4	times 27:9	tons 215:15
thorough	time 4:6,7 5:7	46:23 47:2	took 24:14
201:13 265:9	10:14 21:21	58:13 99:13	47:10 57:11
thought 36:20	39:20 44:9	125:11,11,15	222:2 229:6
37:23 48:23	45:23 47:15,15	125:16 143:18	243:3 251:22
50:18 56:1	54:22 56:1	144:8	285:12
58:8 67:5,10	59:18 61:21	title 116:11,18	tool 44:13
96:24 99:12	120:22 123:23	132:8 228:10	217:24 223:14
133:23 139:24	130:4 133:5		223:15,16,18

[tool - turned]

223:19 248:21 248:23 282:21 282:24 tools 40:5 221:24 222:1 223:22 248:23 top 102:1 108:22 120:15 126:8 155:2 168:6,7 169:23 170:6 173:25 176:16 183:20 186:7 187:8,9 188:8 204:5 216:16 255:22 topic 62:7,7 99:8 166:21 179:22 233:1,5 284:14 topics 166:6 218:23 233:3 topmost 208:5 208:13 topologically 170:1 tortuous 43:19 total 14:10 296:14 totally 43:18 68:8 140:8 142:11 236:15 touch 60:4 131:12 towards 9:18 13:4 17:1 42:7	track 196:21 198:12 trade 24:10 25:18 124:15 trademark 8:7 tradition 30:16 traditional 110:19 133:16 170:5 traffic 198:17 trains 77:24 transcribed 26:17 27:22 297:15 transcript 129:22 297:17 299:6,8,10,13 299:13,22 300:2,2 transcription 297:18 transfer 85:4 176:7 transferred 75:24 121:17 transistors 167:12 282:13 transition 9:21 translated 147:14,15 transparent 77:11 147:2 260:1 transport 38:3 38:4 74:25	75:15 76:1,4 76:13,17,20,23 85:11,20 119:3 175:2,3,17 176:12 177:7 178:2,7 179:11 180:1,10,10,23 181:1,15 271:4 271:14 289:12 289:24 290:19 291:9,18,19 transporting 76:18 84:19,20 180:4 289:19 291:25 292:1 transports 118:25 traveling 29:9 treatment 124:11,16,17 125:1,2 126:14 trend 3:11 triangle 120:12 tried 245:22 247:2 trigger 24:21 256:9 triple 87:23 89:5 trips 223:4 trivial 218:24 trouble 180:6 true 136:2 158:22,23 162:7 214:14	228:11 229:10 229:15 247:5 257:19 262:17 297:18 truly 107:17 109:7 154:5 trust 63:17 64:1 trustworthy 105:3 truth 5:25 6:1,1 99:9 103:15 104:8 109:5 136:15 188:9 197:12 236:1 246:9 291:21 297:15 truthfully 246:2 247:1 250:4,5 try 69:21 70:6 99:1 254:9 trying 48:24 51:20 64:13 210:4 214:23 215:10,21 220:3 221:11 221:19 223:21 237:21 250:2 252:24 284:6 tunability 120:6,7 turn 203:24 turned 143:6
--	--	--	---

[tv - uniformity]

tv 89:24 92:25 96:18 97:11 100:2 295:16 tv s 91:15 95:13 96:3 266:5,18 295:9 two 10:1 13:18 14:25 15:4,5 18:6 21:20 22:23 23:14,24 24:4 26:5 29:2 35:20 41:5 43:5 47:11,15 47:18,19,19 51:6 59:15 76:10,18 89:5 90:18 92:11 102:3,4 107:19 107:22 109:24 110:1,12 113:20 118:14 119:4 125:11 131:17 135:2 137:5 164:2 167:17,21 170:19 171:12 172:2 179:23 184:5 188:18 194:10 195:9 198:1 199:3,7 218:16 227:19 247:22 264:13 281:17 type 12:4 19:10 53:7,22 77:13	91:14,23 93:2 93:13 94:9,20 110:8 119:23 119:23 158:11 201:5,8,11 276:17 291:7 294:8 types 10:21 80:23 typewriting 297:16 typewritten 297:17 typical 156:16 156:23 157:9 160:11,14 typically 40:21 49:14 74:14 77:13 136:21 174:22 185:11	uncoated 213:6 uncovered 213:7 214:16 236:9 238:7 uncovering 207:9 under 6:2 8:2 16:16 35:14 39:19 61:8 84:21 106:7 131:19 156:17 157:10 158:18 160:16,20 183:15 193:5 203:23 220:18 228:25 239:20 272:11 undergraduate 132:24 133:3 255:2 undergraduates 254:20 underneath 99:4 170:22 177:24 203:25 205:15,16 understand 15:12,15 31:1 46:20 52:25 53:2,20 57:17 69:13,15 82:2 82:3 91:11 126:11 139:17 139:21 147:21 152:2 167:21	172:5 209:4 216:3 222:11 273:18 284:5 287:9,10,13 289:17,24 290:2,5,17,24 291:2 understanding 10:20 22:20 53:4,21 56:22 57:24 60:19 77:19 89:10 106:24 197:3 197:16 217:8 240:4 understands 30:19 understood 91:11 104:12 174:6 183:16 197:2 218:9 219:2 229:8 287:6 undertook 11:5 11:18 12:2 undisputedly 273:8 unfortunately 85:17 217:22 uniform 11:21 99:5 226:11 uniformly 136:17 uniformity 98:7 137:24
	u		
	u.s. 3:9 70:25 71:15 udc 65:21 268:18,21 269:1 273:9,9 273:14 ugly 159:5 uh 210:13 ultimate 143:23 unable 56:10 unavailable 56:11		

[uniformly - using]

uniformly 206:7	103:18 104:5,6 107:23 110:17	67:23 68:15 69:2 74:15,22	295:11,13,13 295:20,23
unique 63:7 260:9	113:23 115:7,8 115:9,17,21	74:23,24 75:4 75:12,13,14,18	296:15 uses 18:25
unit 4:16	126:20 128:10	76:3,10 81:5	130:10 266:18
united 1:1 4:21	130:13 136:19	87:15 88:17	274:16
units 291:17 296:15	144:17 145:2 146:24 147:10	89:18 90:5,15 90:24 91:1,5	using 5:1 11:22 12:14 13:4,24
universal 66:5 268:19 269:1	153:4,20 166:12,22	91:14,15,21 93:3,7,14 94:5	36:14 38:7 39:2 41:15
universities 47:3	167:12 169:23 171:6 172:18	94:9,11 95:3 97:9,20 99:12	42:16,19 48:8 49:24 59:21
university 10:13 21:2 176:18	176:3,3,4,5,23 177:14,22	100:7 103:1,13 105:20 106:20	67:22 73:9 76:16 85:9
unix 259:6,20	178:7 181:8,9 182:4 206:5	107:22 110:10 114:4 115:18	89:12,13 92:19 92:25 93:11
unmute 164:2	207:15 209:21	131:12 134:7	96:22 106:17
unmuted 164:2	213:1 217:3	136:22 140:21	107:3 115:17
unwanted 98:9 137:7	225:2,12,14 226:11 230:1,8	147:1,2 152:9 153:9 165:4	127:10 128:5 128:16,20
upcoming 95:18	238:8 252:19 252:22 259:23	166:3,14,16,18 166:25 167:4,7	129:10 130:17 136:15 137:1
upside 186:7	261:12 262:14	169:16 175:6	141:1,12
urquhart 2:13	262:24 267:6	175:17,25	144:18 145:5,9
usability 73:25 74:19 130:24	268:19,21 273:7 276:9,23	176:17 178:8 207:21 210:23	146:17 149:14 150:19 152:21
usage 264:17	280:11 284:14	212:17 227:13	153:3,14 154:9
use 13:8,17 19:10 36:21 40:11 46:2 48:17,20 49:21 51:10,17 53:7 66:4 68:24 69:1 77:2 89:11 97:4	285:19 286:15 288:24,25 295:16 used 13:5 19:11 33:20 37:8 41:12 43:4 45:11 50:11 51:11 67:13,15	247:21 248:5 253:12 255:14 266:18 267:3 271:3,11,12,18 271:19,23 273:13 274:10 276:21 277:25 282:16 294:9	168:19 174:22 209:22 213:3 218:8 219:8 225:8 226:5 229:18 230:9 239:9 240:17 240:22 247:8 247:20 252:2

[using - volume]

253:8 255:8 261:9 262:10 263:11,13,19 274:22 276:17 277:8 279:23 280:16 282:3 usually 24:13 47:2 114:2 158:8 198:5,5 206:2 252:5 utilization 137:21 utilized 137:16 uv 151:25 216:15 247:8 247:14,16,24 248:3,5	vapor 206:10 276:21 variability 224:23 variable 162:13 162:14 varies 69:1 variety 11:25 195:24 various 36:24 38:17 198:4 vary 29:2 vendor 142:10 222:2 vendors 17:5 45:17 221:25 verification 166:19 verified 166:2 verify 111:17 veritext 5:3 296:16 299:7,9 299:11,20 versa 142:12,17 version 97:10 versions 97:10 versus 4:20 42:19,19 43:4 49:11 85:19,23 103:15,18 126:22 130:18 133:16 137:1 137:11 142:3 148:2 150:4,19 152:13,22	153:4,14,20 155:22 156:18 162:17 212:10 218:22 268:10 278:23 289:13 viability 46:17 viable 82:7 83:3 167:23 221:19,21 225:12 278:25 279:12 vice 142:11,16 video 4:13,17 videoconfere... 1:15 2:1 videographer 2:18 4:5 5:4,16 6:3 52:10,13 111:10,13 112:12 163:5,8 231:14,17,19 296:4,12 videotaped 1:15 view 49:2 53:9 98:6,7 151:17 168:18 226:5 288:9 289:24 violating 252:9 272:17,20,24 273:13,22 violation 262:17,20 274:4,7 275:3	virtual 5:1 virtually 4:9 viscoelastic 45:17,21 viscosity 45:12 45:13 visibility 291:15 vision 13:9 vitae 3:7 vitex 41:13 42:3,4,5,6,12 42:23 43:23 131:14 145:6 145:18 146:21 156:1 210:24 211:10 213:2 214:6 217:11 217:14 224:6 237:9 240:8,14 247:18 265:12 279:8 voice 163:22 voltage 161:21 167:13 168:21 168:21 170:14 170:16,20,21 170:23 171:15 171:22 173:3 175:9 voltages 182:5 volts 161:24 volume 84:16 266:25
v			
v 299:4 vacuum 10:19 12:21,23 17:24 18:7,9 35:3,6 36:1,6,10,14,17 93:24 172:7 175:1 244:8 vaguely 28:11 155:21 176:8 238:18 valid 264:1 validity 60:23 61:23 62:5 65:6,12 66:13 66:19 275:11 value 135:6			

[vs - witness]

vs 1:6	wanted 15:16	225:11 230:2	113:10,21,21
w	15:18 34:8	233:15,16	113:24 116:12
wafer 202:19	47:22 50:22	236:2 237:25	116:19 118:10
202:22,23	51:15,16 53:6	238:21 240:2,4	118:23 119:14
204:14,15,20	53:9 59:19	241:14 252:2,2	120:4 121:3
204:22,24	102:25 141:18	252:25 255:9	255:9
205:3 214:15	165:23 208:18	262:8 277:7	whites 49:5
wafers 202:5	222:8 258:2	286:12,25	114:5
205:12	259:6	295:6 297:20	withdraw
wait 92:2	washington	297:21	30:11
148:19 158:12	2:15	ways 22:16	witness 4:12
280:3	watch 59:25	92:11 113:20	5:19 6:25 7:13
waiting 143:3	watches 91:23	135:17 176:2	7:18 8:15,24
waived 297:24	270:15	207:4,9,14	18:19 19:3
299:24,24	water 43:7,8,20	237:21 240:2	20:9,17 27:8
waiving 299:21	173:10	we've 52:2	27:20 28:10
wall 161:9	watts 161:10	162:25	29:12,17,19,23
want 25:23	way 11:19 13:7	weaker 66:10	30:1,13,13,16
46:5 49:23	13:8 36:18	wednesday	30:17,22,25,25
52:3,4 80:23	39:25 43:12	1:17 2:2 4:2	32:8 33:11
98:14 101:18	49:22 51:7	297:11	34:6,23 37:8
111:5,6,16	63:7 67:16	week 164:5	38:22 39:18
131:13,15	85:14 90:24	weight 138:5	41:11 44:11,24
134:1 144:7	106:25 121:2	welcome 52:16	46:20 50:7
145:22 146:5	128:3 131:22	111:16 231:22	51:23 52:6
163:1 165:14	132:12 136:3,6	went 45:22	53:24 54:7
165:24 171:19	139:22 143:20	197:16 228:4	55:20 56:12
178:9,13,21,23	145:8 147:10	236:20	61:8 62:15
179:3,7,14,15	148:2 167:16	west 2:18 5:2	63:4,19 64:4
179:17 212:1	175:11 190:9	wet 158:3	64:13 66:17,24
213:7 214:12	205:19 207:18	whatsoever	69:18 70:11
215:18 229:9	211:14 213:2	257:14	71:2,5,13
230:16 240:7	215:19,21	white 13:19,24	72:14,20 73:24
263:8 274:2	216:3,22	14:1 49:2,6,7,9	74:17 75:7
293:5	224:23 225:2	51:2 68:2	81:8 82:1

[witness - worked]

83:19 84:7	196:3,12,19,22	268:6 269:7,14	66:18 172:13
88:8 89:22	199:6 200:5	270:19 271:17	198:8 216:15
90:18 91:8	202:14 203:10	272:8,15 273:6	235:20 289:23
92:4,7 101:7	203:16,22	274:1 275:23	290:2
103:7 104:25	204:20 205:14	277:2 279:16	work 3:10 7:14
105:25 106:23	205:22 206:5	280:5,14 281:3	10:11 11:18
107:7 109:1,23	206:21 207:8	281:14 283:2	12:2 17:1
113:18 114:13	208:11,25	283:13,22	23:19 28:21
115:5,15 122:8	209:12 210:9	284:4,13 285:9	32:2,16 36:3
122:25 124:8	212:14 215:2	285:23 287:8,8	37:18 39:4
127:1 130:3,23	216:1,3,13	287:14 288:7	40:14,16 45:16
132:5 136:14	218:20 219:17	292:15 293:12	45:22,25 46:12
137:15 139:17	220:7 221:14	293:22 296:6,9	46:16 47:1,4
141:4 149:9,16	223:13 224:12	297:10,14	50:1 51:25
153:8,17,23	228:10,17,21	298:1 299:13	53:22,25 69:23
154:12 155:5	230:1 231:8	299:16 300:2,5	82:13,24 83:14
155:16 156:8	232:8,16 233:1	witnessed	84:22 88:23
156:20 157:7	233:8 234:16	30:10 183:16	92:15 98:3,3
157:15 158:15	235:9 237:4	212:6	99:12 112:6,15
159:12 163:25	239:7,24 241:7	witnesses 185:9	117:22 119:2
164:4 165:18	241:24 242:18	witnessing	133:1 143:9
165:22 167:10	243:7,19 244:1	185:12,13,15	150:21 154:4
168:1,15 172:5	244:18,25	196:20,22	175:13 176:21
175:20 176:15	246:4,18,22	197:15,16	180:15 201:17
177:17 178:4	249:5,10	wondering	210:23 211:9
179:1 180:13	250:15 251:6	240:9	216:23 220:3
180:25 181:6	251:16 253:11	word 27:21,24	221:25 229:19
181:22 182:12	254:18 257:24	66:18 68:10	235:21 236:17
183:6 185:7,10	258:12,20	69:3 82:3	237:18 239:20
185:24 186:5	259:2,15	102:4 104:6	239:22 242:8
186:20 187:13	260:15 261:14	114:1 146:4	255:6 289:2
187:18,23	262:1 263:5,15	149:9 150:5	290:24
189:15,23	264:10 266:7	240:22 290:11	workable 47:21
190:12,23	266:12,22	words 7:6	worked 8:24
191:5,11,18	267:17,24	19:16 43:19	21:2,5,18

[worked - yang]

31:17 59:20	worse 157:21	30:15,24 32:6	154:11 155:4
67:3 222:24	worth 24:8	33:10 34:5,22	155:15 156:7
235:11,13	62:18 64:18	38:19 39:17	156:19 157:6
236:19 238:21	wow 173:24	41:10 44:10,23	157:14 158:14
239:24 240:5	write 26:21	46:19 50:6	159:11 163:3
255:7 257:20	89:13	51:22 52:5	163:24 164:1
260:2	writeup 184:19	53:23 54:5	165:14,19
working 10:18	184:20 187:5	55:13 56:7,25	167:9,25
23:21,24 31:11	writing 78:2,5	57:5,8 61:6	168:14 172:4
32:18 35:18	184:15,17	62:14 63:3,18	175:19 176:14
42:7 43:23	187:9,10,11,20	64:3,12 66:15	177:16 178:3
47:8,23 48:1,4	244:4 285:25	66:22 69:17	178:25 180:12
48:7,11 54:3	written 21:16	70:9 71:4,9,12	180:24 181:5
73:6 129:8	23:16 46:14	72:11 73:23	181:21 183:3
133:22 200:20	79:8 117:6	74:16 75:6	185:6,23 186:4
211:20 213:22	191:5 199:17	81:7,25 83:18	186:19 187:3
215:5 218:1,4	238:17	84:6 86:15	187:12,17,22
218:5,10 219:3	wrong 98:10	88:5 89:20	189:1,14,22
219:13,14	wrote 68:23	90:17 91:7,25	190:11,20
222:1,4 237:7	160:15 188:7	92:5 103:6	191:4,9,17
244:7,8 248:25	195:25 246:1	104:24 105:22	196:2,11,18
289:25 291:23	285:23	106:22 107:6	199:5 200:3
works 137:6	x	108:25 109:22	202:12 203:9
156:14 210:23	x 3:1,5 123:7,9	111:7 113:16	203:15,21
230:11,18,18	297:25 300:9	114:11 115:4	204:19 205:13
world 35:5	xerox 10:13	115:14 122:7	205:21 206:4
62:5 73:4	y	122:24 124:7	206:15,18
128:24 173:16	yamagata	126:24 129:20	207:7 208:10
174:19 262:9	176:18	130:22 133:20	208:22 209:11
worldwide 10:3	yang 2:14 5:14	134:3,8,14	210:8 212:13
15:23	5:14 7:13 8:9	136:13 137:8	215:1,25 216:2
worry 144:22	8:23 18:16	137:14 139:16	216:12 218:19
153:25	19:2 20:7,16	141:3 149:6,15	219:16 220:6
worrying 238:5	27:7,18 28:9	152:25 153:7	221:13 223:12
		153:16,22	224:11 228:9

[yang - zhong]

228:15,18	293:11,21	215:14 221:3	268:13 269:15
229:25 231:7	296:7	225:12 234:5	291:23
231:13 232:7	yeah 13:11	251:19 271:25	yep 73:18,21
232:15,25	25:4,25 31:10	277:20 286:9	82:16 83:14
233:7 234:15	37:15 49:1	293:6	105:11 116:7
235:8 237:3	55:13 60:11	year 6:20 9:9	132:5,11,14
239:18 241:3	70:16 71:11,18	14:15,16,21	148:14 164:17
241:21 242:17	78:18 83:2	23:13 24:25	182:12 184:3
243:6,17,25	86:16 100:15	44:3,3 47:4	184:12,19
244:17,24	101:4 104:16	54:19,20 55:9	185:19 193:7
246:3,17 249:4	105:13,25	59:15 61:18	193:24,24
249:9 250:10	114:13 117:5	198:24 199:17	194:2,24 195:1
250:14 251:5	119:19,25	234:3 235:2,6	195:19,21
251:15 253:10	120:21 121:1	239:25 254:5	208:2,17
253:19 254:17	124:8 130:14	254:14 268:9	yield 50:22
257:23 258:11	135:21 141:25	years 10:1,16	96:21 99:21
258:19 259:1	147:7,12	11:5 14:25	123:21,22,22
259:14 260:14	149:16,24	21:19 22:23	124:2 126:20
261:13,25	150:12 151:3	23:14,23 29:14	153:19 174:4
263:3,14 264:9	153:8,17 160:5	30:6 42:23	z
265:3 266:6,10	165:3,22,24	43:20 47:11,15	z 105:12,16,16
266:21 267:16	174:19 176:22	47:18,19,19	106:7,20
267:23 268:5	178:18 179:1	59:2,3,4,7,10	107:13
269:6,13	180:3 183:7,23	59:11,15 61:16	zhong 2:8 3:3
270:18 271:16	183:25 186:5	69:7 110:10	5:12,12 6:6 7:5
272:7,14 273:5	186:14 187:1	138:19 143:17	7:8,22 8:17 9:3
273:25 275:22	187:15 188:17	151:3 185:8	18:23 19:7
277:1 279:15	190:5 191:15	189:18 192:13	20:12,21 27:10
280:2,13,23	192:11 193:3	192:14 199:1,3	28:2,13 30:21
281:2,13 283:1	196:13 199:20	222:10 227:14	31:3 32:11
283:12,21	200:14,17,25	232:21 248:11	33:14 34:10
284:3,12 285:8	201:4,18,20	250:7 252:11	35:8 37:11
285:17,22	206:22 207:2	253:18 260:23	38:24 40:8
287:2,10,17	207:11,18,20	263:23 264:23	41:16 44:17
288:6 292:14	208:2,3,14	264:25 268:13	45:5 46:22

Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

Veritext Legal Solutions is committed to maintaining the confidentiality of client and witness information, in accordance with the regulations promulgated under the Health Insurance Portability and Accountability Act (HIPAA), as amended with respect to protected health information and the Gramm-Leach-Bliley Act, as amended, with respect to Personally Identifiable Information (PII). Physical transcripts and exhibits are managed under strict facility and personnel access controls. Electronic files of documents are stored in encrypted form and are transmitted in an encrypted

fashion to authenticated parties who are permitted to access the material. Our data is hosted in a Tier 4 SSAE 16 certified facility.

Veritext Legal Solutions complies with all federal and State regulations with respect to the provision of court reporting services, and maintains its neutrality and independence regardless of relationship or the financial outcome of any litigation. Veritext requires adherence to the foregoing professional and ethical standards from all of its subcontractors in their independent contractor agreements.

Inquiries about Veritext Legal Solutions' confidentiality and security policies and practices should be directed to Veritext's Client Services Associates indicated on the cover of this document or at www.veritext.com.