

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

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

		)
POSCO,		)
		)
Petitioner,		)
		)
vs.	)	Case No. IPR2019-01275
	)	Patent 9,708,683
ARCELORMITTAL,	)	
	)	
Patent Owner.	)	
		)

PORTIONS OF THIS TRANSCRIPT ARE CONFIDENTIAL

VIDEOCONFERENCE DEPOSITION OF ANTHONY DEARDO, Ph.D.

Thursday, June 18, 2020

Volume I

Reported by:
KATHLEEN E. BARNEY
CSR No. 5698
Job No. 4140260

PAGES 1-194
PAGES 52-62 ARE CONFIDENTIAL AND ARE BOUND SEPARATELY

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD
3
4

5 POSCO,

6 Petitioner,

7 vs.

8 ARCELORMITTAL,

9 Patent Owner.
10
11

)

)

)

)

)

)Case No. IPR2019-01275

)Patent 9,708,683

)

)

)

)

12 Videoconference deposition of ANTHONY DEARDO, Ph.D.
13 Volume I, taken on behalf of POSCO, beginning at
14 8:00 a.m. and ending at 2:34 p.m. on Thursday,
15 June 18, 2020, before KATHLEEN E. BARNEY, Certified
16 Shorthand Reporter No. 5698.
17
18
19
20
21
22
23
24
25

1 APPEARANCES:

2

3 For Petitioner:

4

5 MORGAN, LEWIS & BOCKIUS LLP

6 BY: DION BREGMAN, ESQ.

7 ALEXANDER STEIN, ESQ.

8 HOSANG LEE, ESQ.

9 1400 Page Mill Road

10 Palo Alto, California 94304

11 (650) 843-7278

12

13 For Patent Owner:

14

15 DAVIDSON, DAVIDSON & KAPPEL

16 BY: DAVID PETROFF, ESQ.

17 CARY KAPPEL, ESQ.

18 589 8th Street

19 New York, New York 10018

20 (212) 736-1940

21

22 Videographer:

23

24 NICHOLAS GLANTZ

25

Page 3

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

INDEX

WITNESS

EXAMINATION

ANTHONY DEARDO, Ph.D.

Volume I

BY MR. BREGMAN

6

PREVIOUSLY MARKED EXHIBITS

NUMBER

PAGE

Exhibit 1001

57

Exhibit 1050

52

Exhibit 1013

77

Exhibit 2010

9

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

Thursday, June 18, 2020

8:00 a.m.

THE VIDEOGRAPHER: Good morning. We are
going on the record at 8:00 a.m. on June 18, 2020. 08:00:46
This is Media Unit 1 of the video-recorded
deposition of Dr. Anthony DeArdo taken by counsel
for petitioner in the matter of POSCO v.
ArcelorMittal filed in the United States Patent and
Trademark Office. This deposition is being held 08:01:11
remotely on the Zoom platform. My name is -- sorry.
On the Webex platform.

My name is Nicholas Glantz from the firm
Veritext and I'm the videographer. The court
reporter is Kathy Barney from the firm Veritext. 08:01:27
I'm not related to any party in this action, nor am
I financially interested in the outcome.

Everyone attending the meeting remotely will
now state their appearances and affiliations for the
record. If there are any objections to the 08:01:42
proceeding, please state them at the time of your
appearance, beginning with the noticing attorney.

MR. BREGMAN: This is Dion Bregman for POSCO.
With me are my colleagues Alex Stein and Hosang Lee.

MR. PETROFF: This is David Petroff, 08:02:00

1 P-E-T-R-O-F-F. I'm with my colleague, Cary Kappel,
2 with the firm Davidson Davidson & Kappel, and we
3 represent ArcelorMittal. And we're here with our
4 witness, Dr. Anthony DeArdo.

5 THE REPORTER: Shall I swear in the witness? 08:03:13

6 THE VIDEOGRAPHER: Will the court reporter
7 please swear in the witness.

8
9 ANTHONY DEARDO, Ph.D. ,
10 having been administered an oath remotely, was
11 examined and testified as follows:

12
13 EXAMINATION

14 BY MR. BREGMAN:

15 Q Good morning, Dr. DeArdo. Did I pronounce 08:03:38
16 your name correctly?

17 A It's close. DeArdo.

18 Q DeArdo. Good. Let me make sure I get that
19 right.

20 So, Dr. DeArdo, did you -- have you had your 08:03:53
21 deposition taken before?

22 A Yes.

23 Q How many times?

24 A Oh, maybe three times.

25 Q Okay. All in patent cases? 08:04:07

Page 6

1 A No.

2 Q What were the other cases?

3 A Personal injury or product liability cases.

4 Q Okay. So you probably know the rules of
5 depositions, but I'll just go through them again 08:04:24
6 just to refresh your memory.

7 As I said earlier, I'm here representing
8 petitioner POSCO in the interparty review that was
9 mentioned earlier.

10 Even though you're testifying virtually 08:04:41
11 today, do you understand that the testimony you give
12 under oath here is subject to the same penalty of
13 perjury as though you were testifying in a
14 courtroom?

15 A I do. 08:04:54

16 Q I will assume that you understand the
17 questions that I ask unless you explicitly tell me
18 otherwise; is that fair?

19 A Yes.

20 Q Is there anything that would prevent you from 08:05:03
21 thinking clearly and testifying truthfully today?

22 A No.

23 Q We'll take a break about once every hour. If
24 you need to take a break any earlier, just let us
25 know. And once you finish answering that line of 08:05:17

Page 7

1 questions, we'll take a break.

2 A Thank you.

3 Q So we're here to talk about IPR 2019-01275.

4 Is it okay if I just refer to that as "the IPR"?

5 A Yes. 08:05:38

6 Q And the patent at issue is U.S. patent
7 9,708,683. Is it okay if I just refer to that as
8 "the patent" or "the '683 patent"?

9 A Yes.

10 Q And I believe you submitted two declarations 08:05:53
11 in this proceeding; is that correct?

12 A Yes.

13 Q The first one is Exhibit 2001 and I'm just
14 going to refer to that as the first declaration.
15 Okay? 08:06:07

16 A Yes.

17 Q And the second one, which is the one we'll be
18 discussing mostly today, which is Exhibit 2010, is
19 it okay if I just refer to it as the second
20 declaration or the declaration? 08:06:20

21 A Yes.

22 Q Great. So hopefully you've got a binder of
23 materials in front of you.

24 A Yes.

25 Q Okay. So why don't we turn to your second 08:06:28

Page 8

1 declaration, which is Exhibit 2010. And we're going
2 to be spending a while on this, so you may want to
3 take it out of the binder if it's in a binder or
4 whatever is most comfortable for you.

5 A Yes. 08:06:45

6 Q And once you find Exhibit 2010, can you just
7 verify that that is your second declaration that's
8 submitted in this proceeding?

9 A It is. Yes, it is.

10 Q Right. And are you representing 08:06:57
11 ArcelorMittal in this proceeding?

12 A Yes.

13 Q And have you ever done any work -- any other
14 work, other than your work in this proceeding, for
15 ArcelorMittal in the past? 08:07:15

16 A Yes.

17 Q What work have you done for them?

18 A I've done some research support over the
19 years from ArcelorMittal.

20 Q What do you mean by "research support"? 08:07:26

21 A Well, in my research group at the University
22 of Pittsburgh, we have -- we have financial support
23 from several steel companies from around the world,
24 including ArcelorMittal and its predecessors.

25 Q And who were its predecessors? 08:08:06

Page 9

1 A Inland Steel mainly.

2 Q And how long ago was this work that you did
3 for ArcelorMittal?

4 A Oh, long time ago. 10 -- 15 years probably.

5 Q And you haven't done any work for them from 08:08:31
6 that research until this current project?

7 A Yes.

8 Q And how much money did you or your university
9 receive from ArcelorMittal with regard to the
10 research work? 08:08:46

11 A I would say three years' worth of funding at
12 maybe 50K a year.

13 Q So 150K?

14 A Yes.

15 Q And what did that money go towards? 08:09:02

16 A Supporting graduate students and research
17 efforts.

18 Q Are you doing any other work for
19 ArcelorMittal right now other than for this IPR?

20 A No. 08:09:21

21 Q Are you assisting them with -- with any of
22 their patent prosecution work on other patents?

23 A I have in the past, but not currently.

24 Q Why don't we turn to paragraph number 5 of
25 your declaration. 08:09:43

Page 10

1 A Okay.

2 Q Let me know when you're there. You'll see
3 the second sentence says:

4 "My expertise includes hot
5 deformation of austenite," 08:09:57

6 A-U-S-T-E-N-I-T-E, "transformation of
7 austenite during controlled cooling,
8 formation, microstructure and
9 properties of martensite,"

10 M-A-R-T-E-N-S-I-T-E, "and bainite," 08:10:34

11 B-A-I-N-I-T-E, "improving the
12 corrosion resistance of steel by
13 surface treatments."

14 Do you see that?

15 A Yes. 08:10:49

16 Q Let's start with the second item in the list,
17 which is the transformation of austenite during
18 controlled cooling. What is controlled cooling?

19 A It's the cooling following hot deformation,
20 in this case. 08:11:09

21 Q Okay. Why don't we take a step back, then,
22 and start with hot deformation and do it in order.

23 So why don't you tell me what hot deformation
24 of austenite means.

25 A Well, it's applying strain for changing shape 08:11:25

Page 11

1 and microstructure of austenite with deformations
2 above the A3 temperature.

3 Q What is the A3 temperature?

4 A That's the -- that's the end of what is
5 called the intercritical range on the phase diagram, 08:11:47
6 on the iron carbon phase diagram.

7 Q And what are the process steps in hot
8 deformation?

9 A Heating the steel to the required deformation
10 temperature, deforming the steel at the required 08:12:15
11 temperature, and then cooling the steel to room
12 temperature.

13 Q And that would be the heat treatment of the
14 steel?

15 A In my case it's called thermomechanical 08:12:33
16 processing.

17 Q Why do you say in your case it's called that?

18 A Because we're not just heating and beating
19 and cooling. We are generating selective structures
20 in the austenite at the deformation temperature. 08:12:49

21 Q Why don't we turn to the next element in the
22 list, which is the transformation of austenite
23 during controlled cooling. What is that?

24 A Austenite, as you know, is a high temperature
25 phase of iron, but as it cools, it transforms to -- 08:13:09

Page 12

1 from an FCC structure to a BCC structure,
2 body-centered cubic.

3 Q And what are the process steps in
4 transformation of austenite during controlled
5 cooling?

08:13:34

6 A The austenite is cooled to different
7 temperatures to allow the transformation to occur.

8 Q When you said earlier -- I said what were the
9 process steps of hot deformation, you included
10 cooling in there as well. But here we're talking
11 about controlled cooling. Are those, the two
12 cooling steps that you mentioned, are they different
13 from one another?

08:13:51

14 A No. I just included the cooling as part of
15 the hot deformation process.

08:14:08

16 Q Are there any steps before this controlled
17 cooling that affect the transformation of austenite?

18 A There could be. Because the austenite grain
19 size has a big effect on the transformation
20 characteristics. And if we hold the austenite too
21 long before or after the deformation of temperature,
22 we would get different results.

08:14:30

23 Q The first sentence of the paragraph says
24 you've got 40 years of experience in the field, and
25 then you go on to list this expertise.

08:14:51

Page 13

1 Was this experience from after October 2006
2 or from before October 2006?

3	A	My years of experience?
---	---	-------------------------

4	Q	Yes.
---	---	------

5 | A Yes, this goes back to the '70s. 08:15:08

6 Q So your experience working with hot
7 deformation and controlled cooling goes back to the
8 '70s?

9	A	Yes.
---	---	------

10 Q And then the last element in that list in 08:15:22
11 that second sentence of yours in paragraph 5, you
12 say:

13	"Improving the corrosion	
14	resistance of steel by surface	
15	treatments."	08:15:37

16 What do you mean by "surface treatments"?

17 A It could be something like nitriting or it
18 could be by otherwise altering the surface. That's
19 surface treatments.

20 Q And these surface treatments would occur 08:16:05
21 after hot deformation and controlled cooling?

22 A Generally, yes, it would be at room
23 temperature on a cooled product.

24	Q Would painting the surface be a surface	
25	treatment?	08:16:22

Page 14

1 A I imagine, yes, we could probably include
2 that, although we've never studied that.

3 Q When you say "we," you mean your lab at --

4 A Right. Exactly. Right.

5 Q Let's turn to paragraph number 10. And this 08:16:41
6 is mainly just because I'm interested about this.

7 You say something about DANA Corporation.
8 Who is DANA Corporation? I've never heard of them
9 before.

10 A They make automotive transmission parts, 08:16:54
11 suspension parts in transmissions.

12 Q If we look at paragraph 11, you say:

13 "I teach graduate courses
14 covering a range a topics, including
15 alloy design, processing, 08:17:16
16 strengthening mechanisms, deformation
17 and fracture of steel and other
18 engineering alloys."

19 Do you see that?

20 A Yes. 08:17:28

21 Q Are you still teaching those graduate
22 courses?

23 A No. I retired from teaching about a year
24 ago.

25 Q So this paragraph is maybe a little outdated. 08:17:35

Page 15

1 It should say, "I taught graduate courses"?

2 A Yes, that's right.

3 Q In this list here you say "strengthening
4 mechanisms." What are strengthening mechanisms?

5 A In this context we're talking about 08:17:51
6 strengthening, generally strengthening low carbon
7 steels.

8 And this would be, for example, grain size
9 strengthening by the Hall-Petch relationship,
10 H-A-L-L, dash, P-E-T-C-H, relationship. 08:18:15

11 Q So this is a method to do with heat
12 treatment?

13 A This is part of it. This is part of it.
14 This is part of the grain refining that accompanies
15 hot deformation and cooling. 08:18:33

16 Q And how would you use heat treatments to
17 strengthen a steel?

18 A Well, some of it's alloy certainly, but part
19 of it is the thermomechanical treatment also.

20 First of all, we would look for grain 08:18:54
21 refinement. Then we would look for precipitation in
22 the final structure during cooling of fine particles
23 for particle strengthening. We would look to have
24 low temperature transformation, which would give us
25 dislocation hardening. We could alloy elements of 08:19:18

Page 16

1 stayed solutions and end up with solid solution
2 strengthening. We could control the
3 crystallographic texture of the austenite and
4 ferrite to get texture hardening. Ferrite and
5 other -- ferrite, bainite, martensite. 08:19:51

6 Q So when you say "grain refinement," does that
7 mean that smaller particles leads to a stronger
8 steel?

9 A Yes.

10 Q And when you mentioned alloying, that's 08:20:04
11 mixing with another metal, mixing the softer steel,
12 I think as you mentioned, with another metal?

13 A Yes.

14 Q Let's go down to paragraph 13.

15 A Okay. 08:20:20

16 Q And I'm looking at page 8. So as that
17 paragraph continues onto the next page --

18 A Yes.

19 Q -- your first full sentence says:

20 "Some topics include short 08:20:32
21 courses tailored to specific types of
22 products and industries, such as
23 advanced high strength steels for
24 automobiles."

25 Do you see that? 08:20:42

Page 17

1 A Yes.

2 Q What are advanced high strength steels for
3 automobiles?

4 A These are relatively new steels, looking at
5 the broad time spectrum. They tend to be a 08:20:59
6 multiphase steels and they are often formed on
7 continuous galvanizing or continuous aluminizing
8 lines.

9 Q When you say "relatively new steels,"
10 can you tell me from what year they started being 08:21:28
11 introduced?

12 A Sure. Sure. I'd say 1975 is probably a good
13 demarcation line between older steels and the more
14 modern steel.

15 Q So cars that were made before 1975 would have 08:21:55
16 less sophisticated, maybe softer steels?

17 MR. PETROFF: Calls for speculation.

18 THE WITNESS: It's going to be weaker,
19 heavier steels.

20 BY MR. BREGMAN: 08:22:14

21 Q And you also mentioned multiphase steels.
22 What is that?

23 A One of the common multiphase steels in use in
24 body in white in cars is what is called the
25 dual-phase steel, two-phase steel, ferrite and 08:22:31

Page 18

1 martensite.

2 Q And what is a phase?

3 A A phase is a region of homogeneous structure,
4 composition and properties.

5 Q And by "composition," you mean a mixture of 08:22:51
6 materials?

7 A No. A mixture of atoms. In our case it
8 would be an iron-based matrix.

9 Q And different phases in that dual-phase steel
10 will have different crystalline structures of the 08:23:13
11 same material?

12 A They could. They could. But generally in a
13 dual-phase steel you have a body-centered cubic
14 ferrite, which can maintain alloying and so forth,
15 plus a certain amount of martensite, which is 08:23:34
16 body-centered tetragonal, crystal structure.

17 Q So that's the same material, just having two
18 different crystal structures, right?

19 A Yes. Transformed at different temperatures.

20 Q And a phase could also be a different 08:24:00
21 compositions -- sorry, let me restate that.

22 Different phases could also be different
23 compositions of materials?

24 A Different phases? That's a good question. I
25 don't know that we make that distinction. 08:24:18

Page 19

1 Q You said earlier you used the word
2 "thermomechanical treatment." How is that different
3 from heat treatment?

4 A Well, heat treatment doesn't involve any
5 deformation, any deformation at high temperatures. 08:24:36

6 Q But a heat treatment process could involve
7 deformation at a high temperature, right?

8 A It could, but it wouldn't be called a heat
9 treatment then.

10 Q Okay. We'll talk about the patents in a 08:25:07
11 minute, which I think refers to heat treatments and
12 includes a stamping process, right?

13 A Correct.

14 Q So isn't that heat treatment including a
15 stamping process? 08:25:18

16 A I'm sorry. Repeat the question.

17 Q Doesn't that heat treatment described in the
18 patent include a stamping process?

19 A Well, if it's a stamped product, then it's
20 been heated to a temperature, hot stamped, and then 08:25:32
21 cooled.

22 Q And what part of what you just said, heated
23 to a temperature, hot stamped, and then cooled, is
24 the heat treatment?

25 A It would be heated to the temperature. 08:25:44

Page 20

1 Q And what about the cooling? Isn't that part
2 of the heat treatment?

3 A That could be considered part of the
4 treatment.

5 Q Let's look at the next sentence or last 08:26:04
6 sentence in paragraph 13. You say:

7 "I also taught several courses
8 involving the hot-stamped coated
9 steels."

10 Do you see that? 08:26:20

11 A Yes.

12 Q What are hot-stamped coated steels?

13 A They are what patent '683 is describing.

14 Q And what is that, just at a high level?

15 A Well, it's the 22 MM B5 matrix substrate 08:26:42
16 coated with aluminum or aluminum alloys or zinc,
17 heated to the A -- above the A3 temperature, hot
18 stamped into an A pillar or a B pillar, and then
19 quenched to form martensite.

20 Q Now, you mentioned an example of hot-stamped 08:27:24
21 coated steels from the patent. But hot-stamped
22 coated steels of course existed long before the
23 patent, right?

24 A Yes.

25 Q And was that -- were hot-stamped coated 08:27:44

Page 21

1 steels that existed prior to the patent, did they
2 have common characteristics?

3 MR. PETROFF: Objection to form.

4 THE WITNESS: I don't have any particular
5 example in mind. 08:28:04

6 BY MR. BREGMAN:

7 Q They all have a coating, right?

8 A Well, they didn't start with coatings. That
9 developed over time.

10 Q I understand, but the words "hot-stamped 08:28:15
11 coated steels," I mean, it's built into the word
12 "coated steels," right?

13 A Yes, yes.

14 Q So hot-stamped coated steels that existed
15 prior to the patent were steels that were coated 08:28:28
16 with some material, and I think you mentioned
17 aluminum or zinc, and then those steels were also
18 being stamped while they're hot, right?

19 A Correct.

20 Q Okay. And these hot-stamped coated steels 08:28:43
21 that existed before the patent, they were all heated
22 to the austenite temperature?

23 MR. PETROFF: Objection to form.

24 BY MR. BREGMAN:

25 Q Is that right?

1 A Yes. If the goal was to reach the very high
2 strength levels, which generally was true, then they
3 would be heated into the austenite field above the
4 A3 temperature.

5 Q And then they would be stamped and then they 08:29:20
6 would be cooled, right?

7 A Right.

8 Q And --

9 A Correct.

10 Q They would be stamped while they were still 08:29:27
11 hot, I assume?

12 MR. PETROFF: Object to form.

13 THE WITNESS: Correct.

14 BY MR. BREGMAN:

15 Q And then they would be cooled, I guess, from 08:29:36
16 the moment they leave the furnace until after
17 they've finished being quenched, right?

18 A Yes.

19 Q And were there specific heating rates that
20 were used prior to the patent that were in common 08:29:49
21 use?

22 MR. PETROFF: Objection to form.

23 (Discussion off the record re audio issues.)

24 BY MR. BREGMAN:

25 Q So my question was, for these hot-stamped 08:31:37

Page 23

1 coated steel processes that occurred prior to the
2 patent, was there a common heating rate that was
3 used to get these steels -- coated steels up to the
4 austenite temperature?

5 MR. PETROFF: Objection. Form. Speculation. 08:31:58
6 Beyond the scope of direct.

7 MR. BREGMAN: Maybe now I'm regretting
8 turning up your volume on your mic.

9 BY MR. BREGMAN:

10 Q Go ahead, Dr. DeArdo. 08:32:10

11 A Yes. I think before this patent, people were
12 using generic heating and cooling rates. Heating
13 rates anyway.

14 Q And do you have any sense for what those
15 generic heating rates were? 08:32:30

16 MR. PETROFF: Objection. Calls for
17 speculation.

18 THE WITNESS: This is not an easy question.

19 BY MR. BREGMAN:

20 Q Go ahead, Dr. DeArdo. 08:32:41

21 A The hot stamping was usually done by
22 third-party stampers, and they may have had their
23 own in-house way of doing things.

24 Q You're saying third parties as compared to
25 who? 08:33:04

Page 24

1 A Well, as opposed to the steel maker. You
2 have a steel maker, you have a hot stamper, and you
3 have an end user.

4 Q And typically the steel maker does not
5 control the rate that the third-party hot stamper 08:33:26
6 uses when heating their steel?

7 MR. PETROFF: Object to form.

8 THE WITNESS: That's my understanding.

9 BY MR. BREGMAN:

10 Q So you don't have a sense for typical heating 08:33:39
11 rates that were used prior to October 2006 when
12 heating and stamping hot-stamped coated steels?

13 MR. PETROFF: Objection. Mischaracterizes
14 the testimony.

15 THE WITNESS: I have no feeling for the 08:34:00
16 heating rates that were used then.

17 BY MR. BREGMAN:

18 Q Do you have a sense for what the cooling
19 rates that were used then?

20 MR. PETROFF: Objection. Form. 08:34:15

21 THE WITNESS: In the early days, the cooling
22 rates were defined by -- from a metallurgical point
23 of view, not from a process point of view, and this
24 changed with this patent. The accepted cooling rate
25 for this steel was somewhere in the range of 27 to 08:34:42

Page 25

1 30 C per second with the type of deformation that
2 would be applied to these sheets. But '683 patent
3 changed that.

4 BY MR. BREGMAN:

5 Q It's your belief that the '683 patent changed 08:35:06
6 that to require a more drastic cooling?

7 A No. A controlled heating. And they also
8 redefined, quote, unquote, cooling rates.

9 Q Let's start -- tackle those one at a time.
10 What do you mean by it changed the controlled 08:35:30
11 heating rate?

12 A Well, it stipulated a range of acceptable
13 heating rates.

14 Q And that's -- I can find that in the claims
15 of the patent? 08:35:47

16 A Yes.

17 Q And you also said that the patent redefined
18 the cooling rate. What did they -- what did the
19 patent redefine the cooling rate from?

20 A From the exit of the blank heating furnace to 08:36:02
21 400 C.

22 Q But you say they redefined it. What was the
23 common understanding of the cooling rate before
24 this -- before the patent?

25 A It would be the rate of cooling -- 08:36:18

Page 26

1 MR. PETROFF: Objection. Asked and answered.

2 BY MR. BREGMAN:

3 Q Go ahead, Dr. DeArdo.

4 A Yes, it was defined by the cooling rate from

5 the end of stamping to 400 C. 08:36:33

6 Q And why 400 C?

7 A That's the Ms temperature of the austenite.

8 Q Let me make sure I understand this.

9 Some amount of steel, some plate of steel is
10 heated to a certain desired temperature. That piece 08:36:54
11 of steel is then moved on a conveyor belt or
12 something to a stamp. A stamp presses down on it
13 and forms it. Is the stamping mechanism also being
14 heated or is that not heated at all?

15 MR. PETROFF: Object to form. 08:37:15
16 Mischaracterization.

17 THE WITNESS: It's heated -- the stamping
18 dies are heated and then water cooled to reflect the
19 cooling rate. So the steel sheet is cooled in the
20 die. 08:37:33

21 BY MR. BREGMAN:

22 Q Is that always the case, or sometimes does
23 the stamp part come out and go into a bath or
24 something else to cool the -- to cool the steel
25 down? 08:37:47

Page 27

1 MR. PETROFF: Objection. Form. Foundation.
2 Calls for speculation.

3 THE WITNESS: Yeah, I can't answer that. I
4 can imagine it could happen, but that's not my view
5 of hot stamping. 08:37:58

6 BY MR. BREGMAN:

7 Q And how -- how does the cooling occur? Is
8 that some sort of liquid that's moved around the
9 die?

10 MR. PETROFF: Objection. Foundation. 08:38:10

11 THE WITNESS: Yes. There are interstices in
12 the die, little tunnels, cavities, where the water
13 cooling medium circulates through to cool the steel
14 die and then the steel.

15 BY MR. BREGMAN: 08:38:31

16 Q I think I've read somewhere that oil could
17 also be used to cool. Is that oil being used in the
18 die or is that a bath or how does that work?

19 MR. PETROFF: Object to form.

20 THE WITNESS: I think you're discussing oil 08:38:53
21 quenching, in which case it would be the hot steel
22 would be quenched in a bath, in an oil bath,
23 circulating oil bath most likely.

24 BY MR. BREGMAN:

25 Q I see. So maybe I'm getting my terminology 08:39:08

Page 28

1 wrong.

2 So there is some cooling that occurs in the
3 die, but then there is some quenching that happens
4 with the part after it exits the die; is that right?

5 A No. In hot stamping, the cooling and the 08:39:20
6 quenching are the same.

7 Q I see. So but when I had read something on
8 oil quenching, that's not in the die, that must be
9 in some bath or something?

10 A Yeah. 08:39:34

11 MR. PETROFF: Objection. Beyond the scope of
12 direct.

13 THE WITNESS: People have been quenching
14 steel for a hundred years. And sometimes a water
15 quench is too severe for the material and it will 08:39:49
16 get quench cracks. To try to alleviate that, they
17 went to a less aggressive quench, for example, oil
18 quench. That's typical in, say, the tool steel
19 industry where small parts are being quenched.

20 BY MR. BREGMAN: 08:40:09

21 Q So what is the actual meaning of the word
22 "quench"? What does quench mean as compared to
23 cool?

24 A I think it's the speed, the speed of cooling.

25 Q Okay. So it just sort of indicates a faster 08:40:20

Page 29

1 cooling than you would have with the --

2 A Correct. Cooling might be air cooling, for
3 example.

4 Q So as far as you know, hot-stamped coated
5 steels prior to October 2006 did not do any 08:40:46
6 quenching in a bath, they're always quenched in a
7 die?

8 MR. PETROFF: Objection. Form.

9 THE WITNESS: For a hot-stamped product, yes.

10 BY MR. BREGMAN: 08:41:23

11 Q Let's go back to your paragraph 6.

12 A Sure.

13 Q I'll let you read that paragraph and let me
14 know when you're done.

15 A Yes. 08:41:56

16 Q So you list some -- the schools that you've
17 taught at or been a professor. Is there anything
18 missing from this list?

19 A No. I've only been a professor at University
20 of Pittsburgh and a visiting professor in Finland. 08:42:20

21 Q Can we go to your CV? And it's down at the
22 end of this document. It's round about after
23 page 81. So it starts maybe 83.

24 A Yes.

25 Q And at the top right under your name it talks 08:42:41

Page 30

1 about "Finland Distinguished Professor"?

2 A Yes.

3 Q And University of Pittsburgh. And it has
4 "Adjunct Professor at Pohang University of Science
5 and Technology, Pohang, R.O. Korea."

08:43:12

6 Do you see that?

7 A Yes.

8 Q And what was that?

9 A That was an honorary position that I was
10 given. And I did deliver seminars to the graduate
11 students at that school.

08:43:29

12 Q And is Pohang University of Science and
13 Technology part of -- does that university have a
14 shorthand name for it?

15 A I think it might be called Postech, but I'm
16 not sure.

08:43:58

17 Q Do you know why it is called Postech?

18 A It was just POSCO Institute of Technology
19 sort of thing.

20 Q So is it your understanding that this
21 university is affiliated with the petitioner in this
22 case, POSCO?

08:44:20

23 A It's supported by POSCO for sure, yes.

24 Q And what is your familiarity with POSCO
25 before this proceeding?

08:44:38

Page 31

1 A I've had a long relationship with POSCO over
2 the years.

3 Q And what does that relationship involve?

4 A They sent a lot of students to my group for
5 education. And I visited there several times. And 08:44:59
6 they've also supported several research programs in
7 my group.

8 Q When you say they supported research
9 programs, was that work done in collaboration with
10 POSCO? 08:45:19

11 A Some of it was, yes. Some of it was on our
12 own.

13 Q And did you ever receive any -- you or the
14 university ever receive any money from POSCO?

15 A Yes. 08:45:31

16 Q How much money would that be?

17 A Generally in the order of, say, 50K a
18 project. 50K a year per project.

19 Q And how many projects did you do per year?

20 A I don't know that we ever did more than one 08:45:48
21 per year.

22 Q Are you still an adjunct professor at
23 Postech?

24 A I think I still hold that title.

25 Q Does POSCO or Postech -- well, let's take a 08:46:01

Page 32

1 step back.

2 Did you ever do any work directly with POSCO?

3 I think you already answered that. Those were the
4 research projects you did?

5 A Yes. My association was mainly with the 08:46:19
6 research groups at POSCO, at both Pohang,
7 P-O-H-A-N-G, and Gwangyang, G-W-A-N-G-Y-A-N-G.

8 Q And those are two physical locations, right?

9 A Yes. Those are the two big plants.

10 Q Go back up again to paragraph 18 of your 08:46:53
11 declaration.

12 A Paragraph 18?

13 Q Yes.

14 A Okay.

15 Q Let me know when you're there. 08:47:45

16 A I'm here.

17 Q Is it your understanding that the
18 scopes (sic) define the scope of a patent?

19 MR. PETROFF: Objection to form.

20 BY MR. BREGMAN: 08:47:56

21 Q That the claims of the patent define the
22 scope of the patent?

23 Let me back up. Let me ask you, what are the
24 claims in the patent? Do you know what those are?

25 A Those are the -- those are the statements at 08:48:10

Page 33

1 the end of the patent that define the area of
2 protection.

3 Q And do those statements that are the claims
4 at the end of the patent, is the area of protection
5 limited to what the words in those claims say? 08:48:45

6 MR. PETROFF: Objection to form.

7 THE WITNESS: I think the patent owner is
8 permitted to write whatever they want in the claims
9 section.

10 BY MR. BREGMAN: 08:49:06

11 Q And the words in the claim define the scope
12 of the claim, right?

13 A Yes.

14 Q In paragraph 19, you say:

15 "I've been instructed that 08:49:14
16 Petitioner bears the burden of
17 establishing unpatentability by a
18 preponderance of the evidence."
19 Do you see that?

20 A I'm getting there. 08:49:32

21 Yes, I see it.

22 Q Is it your opinion that the claims are
23 unpatentable or are patentable?

24 A I think they're patentable.

25 Q And that's based on a preponderance of the 08:49:52

Page 34

1 evidence?

2 A Yes.

3 Q And what does preponderance of the evidence
4 mean?

5 A A majority of the evidence. 08:50:01

6 Q Let's go down to paragraph 25.

7 A Let me get there.

8 Q Second line from the bottom of that page,
9 starts with the word "Third"?

10 A Yes. I have that, yes. 08:50:37

11 Q Okay. And it says:

12 "Third, use of a known technique
13 to improve similar devices (methods or
14 products) in the same way may be
15 obvious."

08:50:55

16 Do you see that?

17 A Yes.

18 Q What do you mean by:

19 "Use of known techniques to
20 improve similar devices in the same
21 way may be obvious"?

08:51:03

22 What is that?

23 A A known technique to improve similar devices
24 in the same way as a claim --

25 Q Sorry. Go ahead. 08:51:41

Page 35

1 A -- may be obvious.

2 Q And it says:

3 "Similar devices (methods or
4 products.)"

5 So if there are similar methods or similar 08:51:52
6 products, it would be obvious if you just used a
7 known technique to improve the method or product,
8 right?

9 A Yes.

10 MR. PETROFF: Objection. Form. 08:52:07

11 BY MR. BREGMAN:

12 Q Then you say:

13 "Fourth, when there is design
14 need or market pressure to solve a
15 problem and there are a finite number 08:52:18
16 of identifiable, predictable solutions
17 to choose from, it would be reasonable
18 for a person of skill in the art to
19 pursue those known options within his
20 or her technical grasp." 08:52:36

21 Do you see that?

22 A Yes.

23 Q What do you mean by "design need"?

24 MR. PETROFF: Objection to form.

25 THE WITNESS: If a market for a product has a 08:52:46

Page 36

1 design need, then it would be reasonable for a
2 person of ordinary skill in the art to pursue those
3 known options within his or her grasp.

4 BY MR. BREGMAN:

5 Q So if there was a design need, a person of 08:53:26
6 ordinary skill in the art, if they knew about a
7 finite number of identifiable, predictable solutions
8 to choose from, it would be reasonable for them to
9 make any modifications or changes to address the
10 design need, right? 08:53:45

11 MR. PETROFF: Objection. Form. Asked and
12 answered.

13 THE WITNESS: Yes.

14 BY MR. BREGMAN:

15 Q And what are the design needs that one faces 08:53:55
16 in -- for automotive steel?

17 MR. PETROFF: Objection. Form.

18 THE WITNESS: Higher strength, thinner gauge,
19 lighter weight.

20 BY MR. BREGMAN: 08:54:25

21 Q Less expensive maybe?

22 A Yes, maybe less expensive.

23 Q And these were always -- these were known
24 design needs from since they started making
25 automobiles, right? 08:54:36

Page 37

1 MR. PETROFF: Objection. Form. Calls for
2 speculation.

3 THE WITNESS: No, I don't think so. I think
4 this all started with the oil embargo in the '70s.

5 BY MR. BREGMAN: 08:54:49

6 Q So from the '70s forward, people knew that
7 with steels, that you would want to make them
8 lighter, thinner, less expensive, stronger, et
9 cetera, right?

10 A Yes.

11 Q Right. Look at paragraph 27.

12 A Okay.

13 Q You say:

14 "I also understand that it is
15 permissible to find obviousness based 08:55:23
16 on hindsight reasoning, so long as it
17 takes into account only knowledge
18 which was within the level of ordinary
19 skill in the art at the time the
20 claimed invention was made and does 08:55:38
21 not include knowledge gleaned only
22 from applicant's disclosure."

23 Do you see that?

24 A Yes.

25 Q What is "knowledge which was within the level 08:55:45

Page 38

1 of ordinary skill in the art at the time of the
2 claimed invention," what does that mean?

3 MR. PETROFF: Objection. Form.

4 THE WITNESS: I would -- this would pertain
5 to someone -- a person of ordinary skill in the art 08:56:05
6 in that technology.

7 BY MR. BREGMAN:

8 Q And that would be knowledge that they would
9 know from reading documents, other patents,
10 attending conferences, et cetera, right? 08:56:17

11 A Yes.

12 Q Maybe also what they learned at university,
13 right?

14 A Yes.

15 Q And you say: 08:56:23

16 "It is permissible to find
17 obviousness based on hindsight
18 reasoning," if you use that knowledge;
19 is that right?

20 A Yes. 08:56:33

21 Q And what does hindsight reasoning mean?

22 A Looking at the existing knowledge base from a
23 new perspective based on, say, a claim.

24 MR. BREGMAN: We've been going about an hour
25 and I'm about to move to something else. Why don't 08:57:38

Page 39

1 we take a little five-minute break.

2 THE WITNESS: All right.

3 THE VIDEOGRAPHER: The time is 8:57 a.m. and
4 we're off the record.

5 (Recess.) 08:57:51

6 THE VIDEOGRAPHER: The time is now 9:08 a.m.
7 and we are back on the record.

8 BY MR. BREGMAN:

9 Q Dr. DeArdo, during the break did you speak to
10 any of your counsel? 09:08:48

11 A No.

12 Q Earlier today you had told me that at some
13 point in the past you had done some patent
14 prosecution work for ArcelorMittal, remember?

15 A Yes. 09:09:06

16 Q And when did you do that work?

17 A That was in the range of 2013 to 2015.

18 Q And was that work related to this patent at
19 all?

20 A This patent? No. 09:09:20

21 Q Was it related to any other patents in this
22 family?

23 A I don't know the legal terminology, but it
24 seems like they were -- the work I did before was
25 vaguely related to this area. 09:09:36

Page 40

1 Q Was it related to aluminum-coated steels?

2 A The first -- no. The first -- the first
3 patent I worked on was by Kefferstein, which was
4 zinc-coated boron steel.

5 Q When you say you worked on, were you an 09:09:59
6 inventor on those patents?

7 A No, no. I was involved in the patent
8 litigation.

9 Q Maybe you misunderstood my question, then.
10 So when I say patent prosecution, I mean involved 09:10:23
11 with getting patent applications through the patent
12 office, helping them get patents.

13 A I don't know that I can answer that.

14 Q Because of what?

15 A I don't know the legal terms or legal 09:10:46
16 ramifications. ArcelorMittal had a patent that was
17 being challenged by three or four big steel
18 companies, and I was defending their patent against
19 these other companies.

20 Q You were helping in the defense of the patent 09:11:16
21 in a litigation?

22 A Yes.

23 Q You were not helping ArcelorMittal get new
24 patents? You weren't helping with claim drafting,
25 et cetera? 09:11:27

Page 41

1 A No, no, no. Defending.

2 Q Okay. Were these proceedings proceedings in
3 the United States or in Europe?

4 A They were in the United States, although the
5 companies were everywhere. 09:11:41

6 Q Okay. Let's turn to paragraph 32, which
7 starts with the description of the '683 patent.

8 Let's do some basic questions first. Do you
9 fully understand the '683 patent?

10 A Yes. 09:12:10

11 Q And we're talking about the whole patent,
12 correct?

13 A Yes.

14 Q And does your understanding of the whole
15 patent influence the opinions you provided in your 09:12:23
16 declarations?

17 A Yes.

18 Q Okay. I'm going to ask you a few questions
19 about the patent now.

20 Why don't we start with paragraph 32 in your 09:12:34
21 second declaration.

22 A Okay.

23 Q And the first -- sorry, the third sentence
24 starts with the words "steel products," the term
25 "steel products." 09:12:50

Page 42

1 Do you see that?

2 A Yes.

3 Q And it says:

4 "Steel products with very high

5 strength of 1500 MPa UTS can be 09:12:56

6 manufactured from the coated hot or

7 cold rolled coated sheets by either

8 cold forming the part, followed by

9 austenitizing and quenching, or by

10 reheating and hot stamping the part, 09:13:19

11 followed by in-die quenching."

12 Do you see that?

13 A Yes.

14 Q So --

15 MR. PETROFF: Mischaracterization of the 09:13:33

16 evidence.

17 BY MR. BREGMAN:

18 Q Can you explain to me what "cold forming the

19 part, followed by austenitizing and quenching"

20 means? 09:13:45

21 A The flat sheet is formed into the final shape

22 at or near room temperature. It then has very low

23 mechanical properties, strength. The steel could

24 then be put in a furnace, reheated to the proper

25 temperature above the A3 temperature, held, and then 09:14:13

Page 43

1 quenched.

2 Q And the heat treatment there occurs after --

3 A The forming.

4 Q -- the forming; is that right?

5 A Yes. 09:14:33

6 Q And the heat treatment is you heat it up to
7 that A3 temperature followed by the quenching,
8 right?

9 A Yes.

10 Q Okay. Now, in the second part you talk about 09:14:42
11 reheating and hot stamping the part, followed by
12 in-die quenching. Can you tell me what that is all
13 about?

14 A Yes. We take a cold, flat strip. We find a
15 blank. The blank is put in the furnace and heated 09:15:07
16 to the -- 20 degrees above the forming temperature,
17 say, removed from the furnace, placed on this
18 conveyor belt, as you mentioned earlier. We take it
19 to the die, put it in the die, the hot die, and then
20 it's hot stamped to the final shape. The water 09:15:30
21 circulating through the die quenches the steel to
22 the MS temperature of 400 C, maybe lower.

23 Q Why do you say "maybe lower"?

24 A Well, I mean, usually it would quench to like
25 the M50 temperature, M sub 50. 09:15:54

Page 44

1 Q And what is the MS 50 temperature?

2 A Not the MS. The M50. MS is the very start
3 of the martensite reaction.

4 Q And the M50 temperature, what is that?

5 A 50 volume percent martensite. 09:16:14

6 Q And you said earlier after reheating, you
7 heat it to about 20 degrees hotter than the stamping
8 temperature. So I'm not following what that means.

9 MR. PETROFF: Objection. Form.

10 THE WITNESS: Well, the thin sheet is going 09:16:44
11 to cool pretty drastically between the exit of the
12 furnace and the entry to the die.

13 BY MR. BREGMAN:

14 Q And that normally drops about 20 percent --
15 sorry, 20 degrees? 09:16:59

16 A Yeah. That's my estimate.

17 Q How long does it normally take from the exit
18 of the furnace to -- by the time it gets stamped?

19 MR. PETROFF: Objection. Calls for
20 speculation. 09:17:15

21 THE WITNESS: I've read that it's somewhere
22 in the range of 10 seconds.

23 BY MR. BREGMAN:

24 Q That's the typical time in temperature drop?

25 MR. PETROFF: Objection. Mischaracterizing. 09:17:25

Page 45

1 THE WITNESS: Yes.

2 BY MR. BREGMAN:

3 Q Now, when you reheat the part and you then
4 stamp it and then quench it, what part of that is
5 the heat treatment? 09:17:59

6 MR. PETROFF: Objection. Form.

7 THE WITNESS: I don't know -- I don't know
8 that you could separate heat treatment out of this
9 hot stamping process.

10 BY MR. BREGMAN: 09:18:16

11 Q What do you mean?

12 A The hot stamping process is a three-part
13 process. You heat the steel to temperature, you
14 stamp the steel hot, and then you quench it in the
15 die. 09:18:30

16 Q So that whole three-step process is really
17 the heat treatment?

18 A It's the hot stamping.

19 MR. PETROFF: Objection.
20 Mischaracterization. 09:18:41

21 BY MR. BREGMAN:

22 Q What is -- so are you saying there is no heat
23 treatment in that process?

24 A It's not considered a heat treatment. It
25 would be for a cold form part, where the part was 09:19:06

Page 46

1 heated up to 900 C for five minutes and then water
2 quenched. That would be the heat treatment.

3 Q Now, if you turn to paragraph -- let me
4 restate that question.

5 So is heating never a part of heat treatment 09:19:47
6 of a coated hot-stamped steel prior to October of
7 2006?

8 MR. PETROFF: Objection to form.

9 THE WITNESS: Could you repeat that, please?

10 BY MR. BREGMAN:

11 Q I'm just trying to figure out if there is
12 some reheating and some quenching, would a person of
13 ordinary skill in the art prior to October of 2006,
14 would they not call that a heat treatment?

15 MR. PETROFF: Objection to form. 09:20:23

16 THE WITNESS: I mean, if you go back and look
17 at that Kefferstein patent, they were doing hot
18 stamping of zinc-coated boron steel.

19 BY MR. BREGMAN:

20 Q And what would the heat treatment section of 09:20:42
21 that process be?

22 MR. PETROFF: Objection. Beyond the scope of
23 direct.

24 THE WITNESS: The hot stamping process would
25 be heating the -- 09:21:19

Page 47

1 BY MR. BREGMAN:

2 Q Sorry. You were saying, Dr. DeArdo?

3 A The hot stamping -- which is not a heat
4 treatment -- the hot stamping would be heating the
5 cold blank to 900 C or so, putting it in the die, 09:21:32
6 hot stamping it at 900 C or so, and then in-die
7 quenching.

8 Q So --

9 A But that's not the heat treatment.

10 Q So you would never call the process of 09:21:54
11 heating, holding it at a temperature, and then
12 quenching or cooling in a stamping -- overall
13 stamping process, you would never call that a heat
14 treatment, right?

15 MR. PETROFF: Objection. Form. Calls for 09:22:12
16 speculation.

17 THE WITNESS: Yeah. I mean, if you are
18 starting with a cold form product and you're trying
19 to convert it from an 800 MPa to 1500 MPa material,
20 then you would take the cold form product, heat it 09:22:34
21 to 900 C, and quench it.

22 BY MR. BREGMAN:

23 Q Let me ask my question again.

24 So in a stamping process, a person of skill
25 in the art would never call the heating and cooling 09:22:50

Page 48

1 combined or quenching combined a heat treatment; is
2 that right?

3 MR. PETROFF: Objection. Form.

4 THE WITNESS: I wouldn't think so.

5 BY MR. BREGMAN: 09:23:05

6 Q Would you ever call it a heat treatment?

7 A No.

8 Q I'd like to introduce a document that I
9 believe is confidential. And I know Cary does
10 prosecution for ArcelorMittal. So, Cary, if you 09:23:23
11 don't mind, I'm going to mark the transcript
12 confidential while we discuss this document and I'd
13 appreciate if you could maybe drop off and then
14 maybe David can ask you to come back once we're
15 done. 09:23:38

16 And to the extent either party wants to use
17 the document later, we'll obviously need to get a
18 protective order in place.

19 Cary, is that okay? You're on mute. Or
20 maybe he is not even there, 09:23:57

21 MR. KAPPEL: Okay. I'll drop off.

22 MR. BREGMAN: David can just ring you when
23 we're done and you can pop back on.

24 So I'm going to ask Alex if you could pull up
25 on the screen documents I'd like to show you, and 09:24:20

Page 49

1 I'm going to mark this portion of the transcript
2 confidential.

3 MR. STEIN: I'm pulling it up right now. So
4 we'll have it up on the screen in a second.

5 MR. BREGMAN: And then Alex can e-mail it to 09:24:37
6 both David and the court reporter and we can get it
7 into the record.

8 MR. STEIN: Yeah. I just need the court
9 reporter's e-mail and then I can do that.

10 THE REPORTER: Yes. It's --

11 MR. BREGMAN: Kathy, can you give your e-mail
12 address?

13 (The court reporter provides her e-mail
14 address.)

15 MR. STEIN: All right. I'll -- just give me 09:25:24
16 a second and I'll send this right now.

17 MR. BREGMAN: And, Alex, if you share that on
18 the screen, if you could move the other documents
19 out of the way.

20 MR. STEIN: I'll do that. I just have the 09:25:35
21 e-mail window open.

22 MR. BREGMAN: Okay.

23 MR. STEIN: Okay. I'm sending the e-mail
24 right now. Okay. The e-mail should reach everyone
25 in a minute. 09:26:09

Page 50

1 MR. BREGMAN: Okay. Just share that
2 document. You're sharing another document.

3
4 * * *

5 (The following portion of the transcript is
6 confidential)
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

Page 51

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

)
POSCO,)
)
Petitioner,)
)
vs.) Case No. IPR2019-01275
)
ARCELORMITTAL,)
)
Patent Owner.)
_____)

THIS TRANSCRIPT IS CONFIDENTIAL

VIDEOCONFERENCE DEPOSITION OF ANTHONY DEARDO, Ph.D.
Thursday, June 18, 2020
Volume I

Reported by:
KATHLEEN E. BARNEY
CSR No. 5698
Job No. 4140260

PAGES 52-62

Page 52

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

_____	)
POSCO,	)
	)
Petitioner,	)
	)
vs.	)Case No. IPR2019-01275
	)Patent 9,708,683
ARCELORMITTAL,	)
	)
Patent Owner.	)
_____	)

Videoconference deposition of ANTHONY DEARDO, Ph.D.
Volume I, taken on behalf of POSCO, beginning at
8:00 a.m. and ending at 2:34 p.m. on Thursday,
June 18, 2020, before KATHLEEN E. BARNEY, Certified
Shorthand Reporter No. 5698.

1 APPEARANCES:

2

3 For Petitioner:

4

5 MORGAN, LEWIS & BOCKIUS LLP

6 BY: DION BREGMAN, ESQ.

7 ALEXANDER STEIN, ESQ.

8 HOSANG LEE, ESQ.

9 1400 Page Mill Road

10 Palo Alto, California 94304

11 (650) 843-7278

12

13 For Patent Owner:

14

15 DAVIDSON, DAVIDSON & KAPPEL

16 BY: DAVID PETROFF, ESQ.

17 CARY KAPPEL, ESQ.

18 589 8th Street

19 New York, New York 10018

20 (212) 736-1940

21

22 Videographer:

23

24 NICHOLAS GLANTZ

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

INDEX

WITNESS

EXAMINATION

ANTHONY DEARDO, Ph.D.

Volume I

BY MR. BREGMAN

56

PREVIOUSLY MARKED EXHIBITS

NUMBER

PAGE

(NONE_

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

MR. STEIN: What do you see on the screen?
You should just see "POSCO BAMPRI Study."

MR. BREGMAN: It's Exhibit 1050. We see 09:26:31
Exhibit 1050. Could you full screen that. Zoom out
a little bit.

BY MR. BREGMAN:

Q Dr. DeArdo, we're going to mark this as POSCO
Exhibit 1050, which we've put in the right-hand 09:26:55
corner there. We added it to the documents
recently.

Do you recognize this document?

A I recognize its title. I'd have to see the
document. 09:27:12

MR. BREGMAN: Okay. Why don't you page
through to the next page, Alex.

MR. STEIN: Okay.

BY MR. BREGMAN:

Q Next page. Do you recognize this figure? 09:27:28

A Yes.

Q What is this?

A This is from the Kefferstein patent.

Q And this is showing what?

A This is showing hot stamping. 09:27:39

1 MR. BREGMAN: And let's go to the next slide,
2 Alex. Next slide.

3 BY MR. BREGMAN:

4 Q Do you recognize this presentation at all?

5 A Yes. 09:27:57

6 MR. PETROFF: Objection. Beyond the scope of
7 direct.

8 BY MR. BREGMAN:

9 Q What is this presentation, Dr. DeArdo?

10 A I think this is from a proposal we sent 09:28:03
11 POSCO.

12 Q Okay. And this proposal was related to --
13 well, firstly, what is HPF?

14 A High performance steel.

15 Q It's not hot press forming? 09:28:20

16 A Hot press forming heat treatment.

17 Q It says, "HPF heat treatment." What does
18 that mean to you?

19 MR. PETROFF: Objection. Beyond the scope of
20 direct. 09:28:39

21 BY MR. BREGMAN:

22 Q What does HPF heat treatment mean to you,
23 Dr. DeArdo?

24 A This is a heat treatment that's meant to
25 simulate hot press forming. 09:28:50

1 Q And does this heat treatment include a
2 heating step, a holding step at that temperature, as
3 well as a cooling step?

4 MR. PETROFF: Objection. Beyond the scope of
5 direct. 09:29:05

6 THE WITNESS: Yes.

7 BY MR. BREGMAN:

8 Q So is it fair to say that at the time that
9 you were working with POSCO, you believed that heat
10 treatments included more than just -- that you could 09:29:17
11 have heat treatments in a stamping process?

12 MR. PETROFF: Objection. Form. Beyond the
13 scope of direct.

14 THE WITNESS: At the end of the day, these
15 are going to be heat-treated products, not stamped 09:29:29
16 products.

17 BY MR. BREGMAN:

18 Q These are not the stamped product we saw two
19 slides earlier?

20 A No. 09:29:39

21 Q Why not?

22 MR. PETROFF: Objection. Beyond the scope.

23 THE WITNESS: Because there is no
24 deformation.

25 MR. BREGMAN: So let's go back two slides 09:29:44

1 earlier, Alex.

2 BY MR. BREGMAN:

3 Q There is no deformation in this process?

4 A This is --

5 MR. PETROFF: Objection to form. 09:29:54

6 THE WITNESS: This does not apply to this
7 study. This is taken from the Kefferstein patent
8 just to illustrate what hot press forming is.

9 BY MR. BREGMAN:

10 Q So in a hot stamping process -- I'll ask my 09:30:06
11 question again -- you will never have something
12 called a heat treatment; is that right?

13 MR. PETROFF: Objection. Form. Beyond the
14 scope of direct.

15 THE WITNESS: In my view, the thermal patents 09:30:20
16 we were looking at two slides down were a heat
17 treatment, not a hot stamping. This is a hot
18 stamping right here.

19 BY MR. BREGMAN:

20 Q And what does it say under the first bullet? 09:30:42

21 "Rolled steel sheet for thermal
22 treatment."

23 Do you see that?

24 A Yes.

25 Q Is thermal treatment the same thing as heat 09:30:59

1 treatment?

2 MR. PETROFF: Objection. Form. Beyond the
3 scope of direct.

4 THE WITNESS: Well, I don't know how the
5 French use their terminology. It could be that the 09:31:10
6 thermal treatment involves hot stamping, but it's
7 not what is conventionally viewed as a heat
8 treatment.

9 BY MR. BREGMAN:

10 Q Does the '683 patent talk about heat 09:31:29
11 treatment?

12 A No.

13 Q It doesn't use the words "heat treatment"?

14 A I don't recall.

15 Q Let's open that document. 09:31:42

16 MR. BREGMAN: Alex, you can stop sharing that
17 now. Alex, you can stop sharing what you're
18 showing.

19 MR. PETROFF: Can we bring back my colleague?

20 MR. BREGMAN: Yes, you can. 09:32:01

21 THE REPORTER: So we're off the confidential?

22 MR. BREGMAN: Yes.

23 * * *

24 (End of confidential portion of the transcript.)

25

I, ANTHONY DEARDO, Ph.D. , do hereby declare under penalty of perjury that I have read the foregoing transcript; that I have made any corrections as appear noted, in ink, initialed by me, or attached hereto; that my testimony as contained herein, as corrected, is true and correct.

EXECUTED this ____ day of _____,
20____, at _____, _____.
(City) (State)

ANTHONY DEARDO, Ph.D.

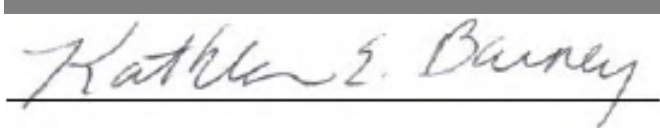
1
2
3 I, the undersigned, a Certified Shorthand
4 Reporter of the State of California, do hereby
5 certify:

6 That the foregoing proceedings were taken
7 before me at the time and place herein set forth;
8 that any witnesses in the foregoing proceedings,
9 prior to testifying, were placed under oath; that a
10 record of the proceedings was made by me using
11 machine shorthand which was thereafter transcribed
12 under my direction; further, that the foregoing is
13 an accurate transcription thereof.

14 I further certify that I am neither
15 financially interested in the action nor a relative
16 or employee of any attorney of any of the parties.

17 IN WITNESS WHEREOF, I have this date
18 subscribed my name.

19
20 Dated: This 23rd day of June, 2020.

21
22 
23

24 KATHLEEN E. BARNEY

25 CSR No. 5698

1 EXAMINATION (continued)

2 BY MR. BREGMAN:

3 Q Let's look at Exhibit 1001, the '683 patent.

4 Why don't we look at column number 1, line 59. Do

5 you see it says: 09:32:40

6 "Heat treatments of the blanks in

7 view of the intermetallic alloying of

8 the coating and austenitizing of the

9 substrate are most frequently

10 performed in furnaces, where blanks 09:32:59

11 are traveling on rollers."

12 Do you see that?

13 A Where are we? I'm -- I don't have the

14 document.

15 Q You should have Exhibit 1001 in your binder. 09:33:08

16 That's the patent.

17 A Okay. All right. Okay, I have it. Okay.

18 And where are we?

19 Q We're on -- firstly, why don't you tell me if

20 you recognize Exhibit 1001? 09:33:25

21 A Yes, I do.

22 Q And what is that?

23 A It's the '683 patent.

24 Q Okay. Why don't we look at column 1, line

25 59. Do you see it says "Heat treatment of the 09:33:44

Page 63

1 blanks" is what it starts with.

2 A Yes.

3 Q What is the patent referring to as heat
4 treatment?

5 A It's the heating -- the heating time of -- 09:34:12
6 heating time of the blank from room temperature of
7 the coated blank from room temperature up to the
8 austenitizing temperature.

9 Q And if we look at the next column, column 2,
10 line 6, it says: 09:34:51

11 "Parts obtained after heating and
12 rapid cooling,."

13 Do you see that?

14 A Column 2 -- what was the line again?

15 Q Line 6. 09:35:01

16 A Yes.

17 Q So it's talking about heating and cooling,
18 right?

19 A Yes.

20 Q That's part of the heat treatment? 09:35:19

21 A Yes.

22 Q So the patent does talk about stamping and
23 heat treatments in the same breath, right?

24 MR. PETROFF: Objection. Form.

25 THE WITNESS: I don't agree. 09:35:31

Page 64

1 BY MR. BREGMAN:

2 Q Why not?

3 A I don't agree that this paragraph and table
4 in column 2 is talking about hot stamping. This is
5 a heat treatment experiment that is done at a steel 09:35:43
6 company.

7 Q Why don't we look at column 3, line 63.

8 Actually, line 56.

9 A Okay.

10 Q 09:36:12

11 "Figure 1 illustrates a preferred
12 embodiment of an invention coated
13 part, after heat treatment and
14 stamping."

15 A Yes. 09:36:22

16 Q Do you see that?

17 A Yes.

18 Q So it is talking about heat treatments in the
19 context of the invention, right?

20 MR. PETROFF: Objection. Form. 09:36:32

21 THE WITNESS: As long as -- as long as the
22 steel is hot stamped at the austenitizing
23 temperature, then I have no problem with that
24 sentence.

25 /////

Page 65

1 BY MR. BREGMAN:

2 Q So let's go back. You previously said that
3 you would never use the word -- or a person of
4 ordinary skill in the art would never use the word
5 "heat treatment" in the stamping context. Do you 09:36:56
6 take that back?

7 MR. PETROFF: Objection.
8 Mischaracterization.

9 THE WITNESS: I think that -- I think that
10 this caption to Figure 1 is describing a hot 09:37:12
11 stamping process.

12 BY MR. BREGMAN:

13 Q So why doesn't it just say "hot stamping"?
14 It says, "after heat treatment and stamping."

15 A I don't know. 09:37:27

16 Q So the words "heat treatment," at least as
17 far as the inventors of the '683 patent were
18 concerned, you had heat treatment in an overall
19 process where there's hot stamping, right?

20 MR. PETROFF: Objection to form. Calls for 09:37:46
21 speculation.

22 THE WITNESS: If we looked at the final
23 product, it would be a stamped product, not a
24 heat-treated product. If we look at that first
25 sentence. 09:37:58

Page 66

1 BY MR. BREGMAN:

2 Q Is Figure 1 not a final product?

3 MR. PETROFF: Objection, form.

4 THE WITNESS: Yes, Figure 1 is a final

5 product.

09:38:13

6 BY MR. BREGMAN:

7 Q So I repeat from that same column 3, line 56:

8 "Figure 1 illustrates a preferred

9 embodiment of an invention coated

10 part, after heat treatment and

09:38:23

11 stamping."

12 So it's talking about heat treatment, right?

13 It's after heat treatment?

14 MR. PETROFF: Objection. Form.

15 THE WITNESS: The important word is "and

09:38:33

16 stamped."

17 BY MR. BREGMAN:

18 Q I understand there's stamping. But there's

19 also heat treatment, right?

20 A Yes. In this particular case, it is -- it

09:38:40

21 does say that, "heat treatment."

22 Q Okay. And heat treatments --

23 A But you asked me if I would use it, and I

24 said no, I would not use it.

25 Q So you think maybe this is just an artifact

09:38:52

Page 67

1 of the way the French would use the term?

2 A I think so.

3 Q So the French would say that you have heat
4 treatment in a stamping process, right?

5 MR. PETROFF: Objection to form. Calls for 09:39:07
6 speculation.

7 BY MR. BREGMAN:

8 Q Is that right?

9 A I don't know.

10 Q You don't know why they use the word "heat 09:39:19
11 treatment" here?

12 MR. PETROFF: Objection. Asked and answered.

13 BY MR. BREGMAN:

14 Q Is that right? You don't know why they used
15 the word "heat treatment" in describing Figure 1? 09:39:36

16 MR. PETROFF: Objection, mischaracterization.
17 Objection, form.

18 THE WITNESS: Well, my answer is you don't
19 need to use heat treatment because the stamping
20 implies the heat treatment. You can't hot stamp 09:39:56
21 without a heating period.

22 BY MR. BREGMAN:

23 Q Does the hot stamping also require a cooling
24 period?

25 A Yes. 09:40:11

1 Q That's also part of the heat treatment?

2 A It's part of the stamping process.

3 Q So cooling has got nothing to do with the
4 heating process, it's just a stamping process; is
5 that correct? 09:40:26

6 MR. PETROFF: Objection to form.

7 THE WITNESS: What I'm saying is the stamping
8 process includes the heating, the hot deformation,
9 and the cooling.

10 BY MR. BREGMAN: 09:40:34

11 Q So the entire process from the time you start
12 with a cold coated product until you end up with a
13 final stamped part has heating, stamping, and
14 quenching, and that process includes what is
15 traditionally known as heat treatment as well as 09:40:56
16 stamping, right?

17 MR. PETROFF: Objection. Form.

18 THE WITNESS: Not in my words.

19 BY MR. BREGMAN:

20 Q So in your words, the entire process when 09:41:07
21 taking some cold coated steel, heating it up,
22 stamping it, and then cooling, that whole process is
23 just called hot stamping? You wouldn't use the word
24 "heat treatment," right?

25 MR. PETROFF: Objection to form. 09:41:23

Page 69

1 THE WITNESS: Right.

2 BY MR. BREGMAN:

3 Q But the French apparently do use the word
4 "heat treatment," right?

5 MR. PETROFF: Objection to form. 09:41:28
6 Mischaracterization.

7 THE REPORTER: Was there an answer?

8 BY MR. BREGMAN:

9 Q Mr. DeArdo, can you repeat your answer? The
10 court reporter didn't hear it. 09:41:42

11 A Yes. The answer is yes, obviously they do.

12 Q Let's look at paragraph 33 of your
13 declaration. And the second to last line of
14 paragraph 33 mentions something called "nugget
15 formation." 09:42:15

16 Do you see that?

17 A Yes.

18 Q Can you tell me what nugget formation is?

19 A Yes. That's part of spot weldability, spot
20 welding. 09:42:29

21 Q What part of spot welding? What is it?

22 A It's the -- it's the melted part that binds
23 the two sheets together.

24 Q Is that the same thing as a weld pool?

25 A I think it is. That's not really my area of 09:42:51

Page 70

1 expertise, but I think it is.

2 Q Would you look at paragraph 34. And onto the
3 next page, the second line down says "a weld pool"
4 at the end of the line.

5 Do you see that? 09:43:16

6 A Wait a second. This is paragraph 34?

7 Q 34, third line, into the third line of
8 paragraph 34.

9 A The sentence that ends in "characteristics"?

10 Q The sentence that ends in "properties." 09:43:56

11 A Oh, okay. Yes.

12 Q So --

13 A What was the question again?

14 Q I was trying to understand what a nugget is
15 and what a weld pool is. 09:44:18

16 A I think a nugget -- the way I look at it, the
17 nugget is a solidified weld pool.

18 Q The very last sentence of that same paragraph
19 talks about "leaving excess free aluminum present."

20 Do you see that?

21 A Yes.

22 Q What does that mean, "leaving excess free
23 aluminum present"?

24 A Aluminum has a pretty low melting point. And
25 the last thing in the world anyone would want would 09:45:12

Page 71

1 be to have an aluminum-rich layer near the weld
2 level, because that would weaken the weldment.

3 Q But isn't the '683 patent specifically
4 directed to having an aluminum-rich outer layer on
5 the stamped part? 09:45:48

6 MR. PETROFF: Objection. Form.
7 Mischaracterizes evidence.

8 THE WITNESS: It's a superficial layer, which
9 is the alloy layer.

10 BY MR. BREGMAN: 09:46:06

11 Q Is that not aluminum rich?

12 A Give me a second here.

13 If you look at Column 6, line 52, 53, you'll
14 see that the aluminum level in the superficial layer
15 is very low. 09:46:54

16 Q Sorry. Can you repeat that?

17 A Yes. If you look at Column 6, line 52, 3, 4,
18 you see the aluminum level is very low in the
19 superficial layer, which is why the spot welding is
20 so good for these steels. 09:47:49

21 Q I see. So how is the aluminum alloy
22 precoating turned into layers on a -- how is an
23 aluminum alloy precoating turned into layers on a
24 base steel?

25 MR. PETROFF: Objection. Foundation. 09:48:22

Page 72

1 BY MR. BREGMAN:

2 Q Do you understand what I mean by saying
3 aluminum alloy precoating turned into layers on a
4 base steel?

5 A I understand. 09:48:37

6 Q How does that occur?

7 A '683 teaches that it occurs by heating at a
8 specified heating rate. And when that -- when that
9 is applied to a precoated sheet, then we end up with
10 the desired four layers, which is a big part of 09:49:03
11 '683.

12 Q It's just the heating rate that's important
13 to get the layers?

14 A Just give me a minute.

15 In my paragraph 41, it's described in a 09:50:06
16 little detail.

17 Q So this heating rate in paragraph 41 is
18 between 4 and 12 degrees centigrade per second?

19 A Yes.

20 Q And, in fact, in paragraph 42 you say that 09:50:27
21 this is a key factor in controlling directly the
22 nature and morphology of the alloyed layers which
23 are formed, right?

24 A Yes.

25 Q So that's -- heating rate is critical to the 09:50:55

Page 73

1 invention?

2 A Yes.

3 MR. PETROFF: Objection.

4 BY MR. BREGMAN:

5 Q Is the heating rate found in any of the 09:51:06
6 claims?

7 Are you looking for the answer?

8 A Yes, I'm looking right now.

9 I don't see the heating rate in the claims.

10 Q But you do believe a person of ordinary skill 09:54:30
11 in the art would understand that the claims require
12 that heating rate, right?

13 MR. PETROFF: Objection.

14 Mischaracterization.

15 THE WITNESS: Okay. Could you -- could you 09:54:59
16 please repeat your question?

17 BY MR. BREGMAN:

18 Q Sure. Do you believe that a person of
19 ordinary skill in the art would understand that the
20 claims require this heating rate? 09:56:47

21 MR. PETROFF: Objection. Asked and answered.

22 THE WITNESS: I haven't -- I didn't look into
23 that. I don't have an opinion.

24 BY MR. BREGMAN:

25 Q But you do believe that this heating rate of 09:57:07

Page 74

1 4 to 12 degrees Celsius per second, as you said
2 earlier, is critical, it's a key factor, right?

3 MR. PETROFF: Objection. Mischaracterizes.
4 Form.

5 THE WITNESS: Yes. 09:57:29

6 BY MR. BREGMAN:

7 Q So if it's a key factor, you would believe
8 that a person of skill in the art would understand
9 that the claims include the key factor, right?

10 MR. PETROFF: Objection. Form. Asked and 09:57:45
11 answered.

12 BY MR. BREGMAN:

13 Q Do you want me to repeat my question?

14 A No, I understand.

15 Yeah, I have no opinion. 09:58:40

16 Q But you spend a lot of time in your
17 declaration saying how important the heating rate
18 is, and you told me earlier that the words in the
19 claims define the scope of the invention. And then
20 you told me that the claims do not include the 09:58:55
21 heating rate. So I'm trying to understand what
22 relevance the heating rate has to the claims.

23 MR. PETROFF: Objection. Mischaracterizes.

24 BY MR. BREGMAN:

25 Q Can you tell me the relevance of the heating 09:59:07

Page 75

1 rate to the claims?

2 A We look -- if we look at the -- column 7 of
3 the patent.

4 Q Okay.

5 A Line 22 to 40, it talks about the importance 09:59:34
6 of the heating rate.

7 Q Okay. And is the heating rate -- how does
8 that influence the scope of the claims?

9 MR. PETROFF: Objection to form.

10 THE WITNESS: I wasn't involved in claim 10:00:06
11 construction, so I can't answer that.

12 BY MR. BREGMAN:

13 Q Does the heating rate show up in any of the
14 claim constructions?

15 A Does it what? 10:00:42

16 Q Is the heating rate in any of the claim
17 constructions that you have relied upon in this
18 proceeding?

19 MR. PETROFF: Objection. Form.

20 THE WITNESS: Repeat, please. 10:00:51

21 BY MR. BREGMAN:

22 Q Is the heating rate in any of the claims
23 constructions that you've relied upon in this
24 proceeding?

25 MR. PETROFF: Objection to form. 10:01:23

Page 76

1 THE WITNESS: Not explicitly.

2 BY MR. BREGMAN:

3 Q Is it implicitly in any of the claim
4 constructions that you've relied upon in these
5 proceedings?

10:01:32

6 MR. PETROFF: Objection to form.

7 THE WITNESS: Well, any time we're discussing
8 layers, that means we're talking about the result of
9 proper heating rate.

10 BY MR. BREGMAN:

10:02:00

11 Q So it's your belief that when we're
12 discussing layers in the claims, they inherently
13 require the specific heating rate of 4 to 12 degrees
14 Celsius per second; is that correct?

15 MR. PETROFF: Objection. Misrepresentation
16 of testimony.

10:02:17

17 THE WITNESS: Yes.

18 BY MR. BREGMAN:

19 Q Was this heating rate of 4 to 12 degrees
20 Celsius per second new and not in the prior art?

10:02:32

21 MR. PETROFF: Objection to form.

22 THE WITNESS: I didn't look into that.

23 BY MR. BREGMAN:

24 Q Are you aware of any prior art references in
25 this proceeding or any other prior art in this

10:02:50

Page 77

1 proceeding where the heating rate of 4 to 12 degrees
2 centigrade -- heating rate anywhere within the 4 to
3 12 degrees centigrade per second was used?

4 MR. PETROFF: Objection to form.

5 THE WITNESS: I didn't look into this, and I 10:03:12
6 have no opinion.

7 BY MR. BREGMAN:

8 Q But it is your opinion that this is what
9 distinguishes the patent from the prior art is that
10 the patent came up with this precise heating range, 10:03:23
11 right?

12 MR. PETROFF: Objection.
13 Mischaracterization. Asked and answered.

14 THE WITNESS: My view is that this patent
15 involves the importance of the four layers, and one 10:03:47
16 gets these four layers by having a controlled
17 heating rate.

18 BY MR. BREGMAN:

19 Q So when you say "controlled heating rate,"
20 everyone in the prior art had a controlled heating 10:04:02
21 rate. It was controlled.

22 A But controlled within those parameters that
23 we quoted.

24 Q So it's the heating range of 4 to 12 degrees
25 centigrade --

1 A Right.

2 Q -- that gives the patent the ability to even
3 have the claimed layers, right?

4 MR. PETROFF: Objection. Form.

5 Mischaracterization. 10:04:23

6 THE WITNESS: I didn't study this looking for
7 other ways of forming these layers, so -- but I
8 doubt that there's another way of doing it.

9 BY MR. BREGMAN:

10 Q So the real magic in this patent, so to 10:04:55
11 speak, the inventive feature of this patent is that
12 it manages to obtain these layers using what the
13 patent calls the key factors of precise heating
14 range of 4 to 12 degrees Celsius, right?

15 MR. PETROFF: Objection. 10:05:21
16 Mischaracterization.

17 THE WITNESS: Yes.

18 BY MR. BREGMAN:

19 Q Now, there's nothing else -- let me back up a
20 little bit. 10:05:38

21 Let's go to the patent claims.

22 MR. PETROFF: We've come to about an hour.

23 So of course you can finish your line of

24 questioning, but I just want to remind you it's been

25 an hour. 10:05:58

Page 79

1 MR. BREGMAN: That's fine with me. Let's
2 take a five-minute break and come back at 10:10.
3 MR. PETROFF: Okay.
4 MR. BREGMAN: I remind you not to discuss
5 your testimony with counsel during the break. 10:06:09
6 THE VIDEOGRAPHER: The time is 10:06 a.m. and
7 we're off the record.
8 (Recess.)
9 THE VIDEOGRAPHER: The time is 10:21 a.m. and
10 we are back on the record. 10:21:38
11 BY MR. BREGMAN:
12 Q Dr. DeArdo, during the break did you speak to
13 your counsel?
14 A I'm sorry. Repeat that.
15 Q During the break did you speak to any of your 10:21:48
16 counsel?
17 THE WITNESS: I can't hear anybody.
18 BY MR. BREGMAN:
19 Q Can you hear me, Dr. DeArdo?
20 A Yes. I'm here. 10:22:06
21 Q During the break did you speak to any of your
22 counsel?
23 A No.
24 Q Okay. Thank you.
25 Why don't we turn to column 5 of the patent, 10:22:15

Page 80

1 lines 22 to 25.

2 A Okay.

3 Q And it says here:

4 "In other words, in a preferred

5 embodiment, at every location on at 10:22:33

6 least one face of the sheet or the

7 blank, the thickness TP of the

8 precoating is preferably from 20 to 33

9 micrometers in thickness, including

10 21, 22, 23, 24, 25, 26, 27, 28, 29, 10:22:50

11 30, 31, and 32 micrometers and all

12 ranges and subranges therebetween, and

13 including all numbers between each

14 listed value as if written out in its

15 entirety (e.g., 22.34 micrometers)." 10:23:13

16 Do you see that?

17 A Yes.

18 Q What does the patent mean there:

19 "At every location on at least

20 one face of the sheet or the blank"? 10:23:26

21 MR. PETROFF: Objection. Calls for

22 speculation.

23 THE WITNESS: Well, we have a flat sheet

24 that's been hot dipped. It comes out and goes

25 through the wiper blades. And there's a precoating 10:23:45

Page 81

1 on one or both sides. And the point is that what
2 this paragraph is trying to say is that at every
3 location, at least the precoating thickness has to
4 fall into these ranges.

5 BY MR. BREGMAN:

10:24:19

6 Q And at every location for this embodiment
7 means that there can't be any locations that have a
8 thickness less than 20 micrometers, right?

9 A Yes, right, right.

10 Q And there can't be any locations where there
11 is a thickness of more than 33 micrometers, right?

10:24:30

12 A Yes.

13 Q Let's go back to your paragraph 44 of your
14 declaration.

15 A Okay.

10:24:45

16 Q And the third full sentence starts with
17 "Cornette."

18 Do you see that?

19 A Yes.

20 Q Cornette, C-O-R-N-E-T-T-E.

10:25:09

21 What are you referring to as Cornette? What
22 is that?

23 A The SAE paper.

24 Q And that's Exhibit -- make sure we're talking
25 about the same thing. It's got a number of exhibit

10:25:28

Page 82

1 numbers, including 1013, 1014 --

2 A Yes.

3 Q -- et cetera. Okay.

4 And you say:

5 "Cornette discloses general 10:25:41

6 conditions for the alloying reaction

7 as were known in the art (i.e.,

8 "generally 900 degrees C, five

9 minutes") (Exhibit 1013 at 9) but is

10 silent on the actual conditions used 10:26:04

11 and the conditions necessary to

12 achieve the alleged four-layer

13 structure of the coating."

14 Do you see that?

15 A Yes. 10:26:14

16 Q Are 900 degrees C and five minutes not actual
17 conditions?

18 A That's the end point.

19 Q So they are actual conditions. It's just the
20 heating rate is not disclosed; is that right? 10:26:32

21 A Yes.

22 Q And the temperature and time in the furnace,
23 as provided by Cornette, is within the range that is
24 described in the '683 patent, correct?

25 A Yes. 10:26:50

Page 83

1 Q The next paragraph says:
2 "As explained in the '683 patent
3 at column 13, lines 13 through 26, and
4 as shown in prior art Figure 2 of the
5 '683 patent, at the time of the 10:27:10
6 invention, conventional heating did
7 not produce a four-layer structure."
8 Do you see that?
9 A Yes.
10 Q What do you mean by "conventional heating"? 10:27:18
11 A Heating -- heating outside of that prescribed
12 range.
13 Q Outside of the temperature range?
14 A Yes. Temperature range, yes.
15 Q And it's your position that Figure 2 of the 10:27:34
16 '683 patent is not covered by the claims; is that
17 right?
18 A Let me look at it.
19 Yes.
20 Q Why is that? 10:28:12
21 A Just give me a second.
22 If we look at in column 3, line 63 through
23 67, you see:
24 "Figure 2 illustrates a coating
25 of a steel substrate after heat 10:29:12

Page 84

1 treatment and stamping which does not
2 correspond to the invention. This
3 succession of layers (interdiffusion
4 layer and intermetallic layer) yields
5 inferior results in resistant spot 10:29:26
6 welding."

7 Q Is there anything else in the '683 patent
8 that describes the Figure 2 embodiment?

9 MR. PETROFF: Objection. Form.

10 THE WITNESS: Well, it doesn't have the 10:29:40
11 four-layer structure.

12 BY MR. BREGMAN:

13 Q Does it say that somewhere?

14 A Okay. If you turn to my declaration.

15 Q Which paragraph? 10:32:01

16 A 47.

17 Q Okay. I see that.

18 A And 49.

19 Q So how can you tell from the '683 patent that
20 it doesn't -- that Figure 2 doesn't have four 10:32:38
21 layers?

22 A Because when you look at Figure 2, you see it
23 has an interdiffusion layer, it has an aluminum rich
24 and metallic layer, and it has this dark undescribed
25 layer. It has three layers, not four. 10:33:01

Page 85

1 Q So what's the -- which are the -- I see
2 something labeled "steel substrate interdiffusion
3 layer" and then "AL rich metallic layer."

4 Is there another layer there?

5 A Yes. 10:33:23

6 Q Where?

7 A I'm sorry?

8 Q You say there are three layers. What are the
9 three layers?

10 A The third layer is this dark background 10:33:28
11 layer.

12 Q Above the aluminum rich metallic layer?

13 A It's mixed in with it.

14 Q So I'm not sure I'm understanding. So --

15 A Okay. Let's start from the bottom. 10:33:46

16 You have this light-looking interdiffusion
17 layer. That's material one. You have this
18 light-looking aluminum rich intermetallic layer,
19 which is located in two different areas. And then
20 we have this dark undefined material which is 10:34:06
21 filling the rest. That's the third layer.

22 Q I don't see a third layer being labeled.
23 You're just determining that from looking at the
24 micrograph in Figure 2?

25 A Yes. 10:34:26

1 Q And if you didn't have any of those labels,
2 would you be able to tell how many layers there are
3 in Figure 2?

4 A Sure.

5 Q How can you tell that? 10:34:39

6 A Well, we could use the same approach that
7 Dr. Miles used, which is by looking at the
8 coloration.

9 Q And what does the coloration tell you?

10 A Well, I don't think it tells you everything, 10:34:54
11 but it gives you an idea anyway.

12 Q An idea of what?

13 A Of what the composition is.

14 Q I'm not following. So it gives you an idea
15 of the composition of each of those different 10:35:11
16 colored bands?

17 A Yes.

18 Q And what is the idea you get here by looking
19 at the micrograph what the composition is of each of
20 the colored bands? 10:35:22

21 A Well, you see the interdiffusion layer is
22 very light.

23 Q Uh-huh.

24 A That means it's iron rich. And then you look
25 at the aluminum intermetallic layers, you see 10:35:35

Page 87

1 they're also very light. Because they're also
2 aluminum rich. But the black matrix remaining is
3 this undefined material which would make up the
4 third layer.

5 Q I see. What is the black color above that 10:36:07
6 top -- what I think you're calling the top aluminum
7 rich metallic layer?

8 A It's part of the darker phase.

9 MR. PETROFF: P-H-A-S-E.

10 THE WITNESS: Thank you. 10:36:51

11 BY MR. BREGMAN:

12 Q I'm talking above that. There's black in the
13 top third of the micrograph.

14 A That's -- that's the air over the sample. Or
15 the mount. 10:37:00

16 Q And it looks like what you pointed to as the
17 aluminum rich metallic, there's one right through
18 the middle of the black band and then there's one at
19 the very surface of the product; is that right?

20 A It's -- that's your interpretation. 10:37:18

21 Q What is your interpretation? It's got arrows
22 pointing to two different things.

23 A Yeah. Someone analyzed this and came up with
24 these labels. I didn't do it. This is what is in
25 the patent. 10:37:41

Page 88

1 Q I understand. So there's two bands of AL
2 rich layers, right? One at the very outer surface
3 and one within that darker band, right?

4 MR. PETROFF: Objection. Mischaracterizes
5 the figure. 10:37:56

6 BY MR. BREGMAN:

7 Q Dr. DeArdo?

8 A Yes?

9 Q Sorry. What was your response? I'll repeat
10 it again. 10:38:03

11 So there's two bands of aluminum rich layers,
12 right? One at the outer surface and one within the
13 darker band, right?

14 A Yes.

15 MR. PETROFF: Objection. 10:38:12
16 Mischaracterization.

17 THE WITNESS: And layer is defined as
18 material. So we have two -- we have the aluminum
19 rich intermetallic layer material and we have this
20 dark undefined other material. 10:38:30

21 BY MR. BREGMAN:

22 Q If we stay away from the word "layers" for a
23 moment, because I know that's a push-button issue
24 here. I'm just talking about these different color
25 bands that you're identifying. 10:38:46

Page 89

1 And it hadn't occurred to me, but now as you
2 describe it, it looks like you've got one
3 light-colored band above the steel and then you've
4 got a dark-colored band above that, and then you've
5 got an AL rich colored band in the middle of the 10:38:59
6 black band, and then you've got another AL rich band
7 at the very top of the surface, which to me is four
8 layers, then.

9 A Well, look at the names on the right side.

10 MR. PETROFF: Objection. Form. 10:39:23

11 BY MR. BREGMAN:

12 Q Dr. DeArdo, if you could just, before you
13 answer, just give a little bit of a break for David
14 to get in his objections.

15 A I'm sorry. Yes. 10:39:34

16 Q Otherwise you talk over each other.

17 So I'm just talking about the colored bands.
18 I understand your position on layers, which we'll
19 get to in a moment.

20 Just on the different colored bands, it looks 10:39:45
21 to me -- and you correct me if I'm wrong -- that
22 you've got the steel, a light colored band, a darker
23 colored band, some lighter colored band in the
24 middle of that, and then at the top of that another
25 lighter colored band. 10:40:02

Page 90

1 MR. PETROFF: Objection to form.

2 BY MR. BREGMAN:

3 Q Which looks like four different colored
4 bands.

5 A Well, I -- I revert back to the figure, the 10:40:11
6 original figure by the patent owner in their
7 research center. And they labeled the bands or
8 layers as shown on the micrograph.

9 Q What do you mean in the research center?

10 A Sorry? 10:40:38

11 Q You said, "in their research center." Where
12 did that come from?

13 A Well, who do you think did this work?

14 Q Does this always occur in a research center?

15 A Most likely. 10:40:53

16 Q And if we compare this to Figure 1, we've got
17 a steel substrate in both; is that correct?

18 A Yes.

19 Q Why do the steel substrates look completely
20 different in the two figures? 10:41:11

21 A I have no idea.

22 Q Is there a way that you can observe different
23 features using different etchants? E-T-C-H-A-N-T-S.

24 Is there a way that you can observe different
25 features in a cross-sectional -- in a cross-section 10:41:47

Page 91

```
1 | like this using different etchants?
```

2	A	Yes.
---	---	------

3 Q So is it possible Figure 2 is using etchants
4 that highlight the steel and in Figure 1 a different
5 etchant is being used?

10:42:11

6 MR. PETROFF: Objection. Calls for
7 speculation.

8 THE WITNESS: I can't answer that. I don't
9 know.

10 BY MR. BREGMAN:

10:42:15

11 Q So why do you think the steel looks different
12 in Figure 1 and Figure 2?

13 A I don't know.

14 MR. PETROFF: Objection. Asked and answered.

15 BY MR. BREGMAN:

10:42:24

16 Q As a person of skill in the art, if you
17 looked at these figures and a grad student gave them
18 to you and they had the steel looking different,
19 would you have an assumption of why those steels
20 look different?

10:42:34

21 MR. PETROFF: Objection. Calls for
22 speculation.

23 THE WITNESS: I can't -- I have no opinion.

24 I can't comment.

25	////
----	------

Page 92

1 BY MR. BREGMAN:

2 Q The entire width of each of these micrographs
3 is about how big?

4 A Well, do you see the line down at the bottom?

5 Q I'm talking about the one outside of the 10:43:04
6 micrograph.

7 A It's 10 -- no. In the black banner on the
8 bottom.

9 Q Okay.

10 A It's 10 microns. 10:43:10

11 Q Okay.

12 A So that whole micro is, what would you say,
13 100?

14 Q Maybe 150?

15 A 150 microns. 10:43:22

16 Q And 150 microns is .15 millimeters; is that
17 right?

18 A Yes.

19 Q Something like .006 inches?

20 A Yes. 10:43:38

21 Q Very, very small cross-section, right?

22 A Yes.

23 Q And if you looked at the entire product,
24 every -- every potential cross-section, would you
25 expect the layers to always be exactly the same or 10:43:56

Page 93

1 would they vary a little bit?

2 MR. PETROFF: Objection, form. Objection,
3 calls for speculation.

4 THE WITNESS: Yeah, I can't answer that. I'd
5 have to think about that for a while. 10:44:11

6 BY MR. BREGMAN:

7 Q Even in this 150 micron cross-section,
8 there's variation in the height of each layer,
9 right? Isn't that right?

10 A Somewhat. 10:44:35

11 Q Looking back at Figure 1, does this image
12 show a coating on a steel substrate?

13 A Yes.

14 Q What part of the image is the coating?

15 A I see it labeled there. A, interdiffusion, 10:45:13
16 B, intermediate, C, aluminum rich metallic, and D,
17 superficial.

18 Q And this image is produced using a scanning
19 electron microscope?

20 A Yes. 10:45:32

21 Q How can you tell?

22 A Well, you can see in the banner on the
23 bottom. You see it talks about 15KV, accelerating
24 voltage. It's hard to read. I think it says 15KV.

25 Q And what is that voltage? 10:45:59

Page 94

1 A That's the accelerating voltage of the beam
2 down the column.

3 Q Which is what you find in a scanning electron
4 microscope?

5 A Yes. Right, right. 10:46:12

6 Q And were the images in Figures 1 and 2 taken
7 of an etched sample?

8 MR. PETROFF: Objection. Calls for
9 speculation.

10 THE WITNESS: I can't answer. I don't know. 10:46:29

11 BY MR. BREGMAN:

12 Q You don't know? Why can't you -- why don't
13 you know that?

14 A Because I wasn't involved in this study.

15 Q So you couldn't tell from looking at the 10:46:37
16 picture or the micrograph whether it was etched or
17 not?

18 A I wouldn't want to do that. That's -- that
19 would be speculating.

20 Q And was this image taken of a -- on a 10:46:52
21 polished surface?

22 A I'm almost certain it was.

23 Q And how do you know that?

24 A Well, it would be hard to get an image
25 without it being pretty flat and pretty well 10:47:17

Page 95

1 polished.

2 Q And how do you go about polishing a sample?

3 MR. PETROFF: Objection. Form. Foundation.

4 THE WITNESS: Standard laboratory practice.

5 A small specimen would be cut, mounted in -- baked 10:47:34

6 in what's called -- in a plastic called Bakelite.

7 So we'd be looking down into, say, the width of the

8 sheet, and then we'd put it through a series of

9 grinding and polishing steps, ending up with a very

10 flat and shiny surface. 10:48:05

11 BY MR. BREGMAN:

12 Q And that flat and shiny surface is what you

13 see in Figures 1 and 2?

14 A Right. This is being imaged in back

15 scattered electrons. 10:48:16

16 Q What does that mean?

17 A Well, that's a certain imaging technique that

18 is used in this type of SEM.

19 Q Why did the first -- why do the first and

20 third layers in Figure 1 look to be the same? 10:48:52

21 MR. PETROFF: Objection to form.

22 BY MR. BREGMAN:

23 Q Do they look to have the same color to you?

24 A Well, I think it's -- I think it's difficult

25 to say. But you have to remember, there was -- 10:49:07

Page 96

1 there was other information available describing
2 these layers. Because we're not just going by
3 looking at an image.

4 Q Uh-huh.

5 A There were mean compositions. There were 10:49:42
6 hardness values.

7 Q So is that, for example, what is described in
8 Column 6 of the patent, starting at line 31:

9 "See, e.g., Figure 1. In a
10 preferred embodiment these layers are
11 as follows:"

12 A Right, right, right, right.

13 Q Is that what you're referring to?

14 A Yes, but that's a little misleading. Because
15 those are ranges of composition. Those -- they are 10:50:14
16 not describing any one location.

17 Q So would layers as claimed -- if you had
18 layers with these ranges, would they be covered by
19 the claims?

20 MR. PETROFF: Objection to form. 10:50:40

21 THE WITNESS: Well, the layer wouldn't have
22 these ranges.

23 BY MR. BREGMAN:

24 Q Okay. I'll --

25 A The layer -- sorry.

1 Q I'll give you an example from this Column 6.

2 So let's say we have four layers, one was an
3 interdiffusion layer that had a particular
4 composition of 86 percent iron, 4 percent aluminum.

5 Just the bottom number on each of these -- 10:51:10

6 A Okay. That's fine.

7 Q -- zero percent silicon, and you did the same
8 for each of the rest of these, the intermediate, the
9 intermetallic, and superficial --

10 A Right.

11 Q -- you use the bottom number on the range.
12 Would that be covered by the claim?

13 MR. PETROFF: Objection to form.

14 THE WITNESS: Yeah, those would be -- those
15 would be the -- that would be the description of the 10:51:30
16 four layers, yes.

17 BY MR. BREGMAN:

18 Q So if you did that, the intermediate and
19 superficial layers would both have the exact same
20 chemical composition, right? 10:51:45

21 A Yes. But remember what I said. We're not
22 comparing ranges. We're comparing particular
23 locations, particular compositions.

24 Q So I'm saying if there was a structure as
25 described in the claim and it had an interdiffusion 10:52:03

Page 98

1 layer, intermediate layer, intermetallic layer, and
2 a superficial layer with the lower end of the range
3 of each one of those elements, would it be covered
4 by the claim?

5 MR. PETROFF: Objection to form. 10:52:23

6 THE WITNESS: Yes.

7 BY MR. BREGMAN:

8 Q It would be? But the intermediate layer and
9 the superficial layer would not be different from
10 one another, right? 10:52:48

11 MR. PETROFF: Objection. Form.

12 THE WITNESS: Repeat what you just said.

13 BY MR. BREGMAN:

14 Q I said but the intermediate layer and the
15 superficial layer would have the same chemical 10:53:02
16 compositions, right?

17 MR. PETROFF: Objection, form.

18 THE WITNESS: This is under your assumption
19 of looking -- taking the lowest value.

20 BY MR. BREGMAN: 10:53:17

21 Q Right. That's my assumption.

22 A That's your assumption.

23 Q Yes.

24 A Yes. And I'm saying that's probably not
25 realistic because the true value would be somewhere 10:53:24

Page 99

1 in the middle of those ranges. And if you do that,
2 you could have millions of possibilities.

3 Q I understand. But I want to know, if you had
4 the exact middle of each of those ranges for both
5 the intermediate layer and the superficial layer, 10:53:43
6 would that be covered by the claims?

7 MR. PETROFF: Objection to form.

8 THE WITNESS: Well, I mean, if the exact
9 middle gives you a replication, then it wouldn't
10 be -- it wouldn't be different. Unless -- unless 10:53:58
11 the hardness is different.

12 BY MR. BREGMAN:

13 Q If I had an intermediate layer with --

14 THE REPORTER: I'm sorry, I can't hear you.

15 THE VIDEOGRAPHER: Yeah, there's something 10:54:44
16 wrong with your mic.

17 The time is 10:55 a.m. and we are off the
18 record.

19 (Discussion off the record.)

20 THE VIDEOGRAPHER: The time is 10:58 a.m. and 10:58:20
21 we are back on the record.

22 BY MR. BREGMAN:

23 Q Right. So before we took a break,
24 Dr. DeArdo, we were talking about Column 6. And
25 Column 6 is specifically talking about Figure 1. 10:58:40

Page 100

```
1      And it says, after it talks about Figure 1,
2      it says -- it actually lists the layers out and
3      says, "See, e.g., Figure 1." And then it says:
```

4	"In a preferred embodiment, these	
5	layers are as follows."	10:58:56

6 And it lists out four different layers. And,
7 as you mentioned to me, those layers have ranges of
8 different metals; is that right?

9	A Yes.
---	--------

10 Q And my question to you was, if the ranges in 10:59:11
11 the intermediate layer and the superficial layer are
12 the same, and you've pointed out we're talking about
13 a specific composition for each layer in the claims.

14 And then my follow-up question was, if you
15 took the bottom number or middle number or the top 10:59:28
16 number, whichever one you want, but it's the same in
17 the intermediate layer for each of the metals in the
18 intermediate layer, as well as for the superficial
19 layer, would those layers be covered by the claims?

20	MR. PETROFF: Objection, form.	10:59:50
----	-------------------------------	----------

21 THE WITNESS: I don't think I can answer this
22 because each layer is going to have its own
23 composition. It's not going to be in the middle or
24 at the top or at the bottom. They're going to
25 presumably be pretty random, randomly located. 11:00:09

Page 101

1 That's the whole point.

2 BY MR. BREGMAN:

3 Q So you're saying when you get diffusion as
4 described in this patent, you will automatically get
5 every layer to be different; is that right? 11:00:29

6 MR. PETROFF: Objection.
7 Mischaracterization.

8 THE WITNESS: I mean, I can't answer that. I
9 can't answer what it would look like. It's pure
10 speculation. 11:00:51

11 BY MR. BREGMAN:

12 Q Okay. Well, I'm referring to the patent.
13 And the patent talks about ranges of elements or
14 metals for all the layers, but the intermediate
15 layer and the superficial layer have the same 11:01:12
16 ranges.

17 You'd agree with that, right?

18 A Yes.

19 Q My question is, would the claims cover a
20 stamped product that has layers from an 11:01:28
21 interdiffusion layer to a superficial layer where
22 the intermediate layer and the superficial layer
23 have the same composition as each other and fall
24 within the ranges mentioned within Column 6?

25 MR. PETROFF: Objection. Asked and answered. 11:01:48

Page 102

1 Form.

2 THE WITNESS: Well, these layers are defined
3 as different materials, which means that each layer
4 would have a different composition.

5 BY MR. BREGMAN: 11:02:03

6 Q And where are the layers defined as different
7 composition?

8 A They're defined as having different mean
9 compositions.

10 Q That's defined in the patent? If you can 11:02:20
11 point me to that definition in the patent, I'd
12 appreciate it.

13 A Yeah. Just give me a second.

14 Q I could point you to page 31 of your
15 declaration. Maybe that will help. 11:04:10

16 A Yeah, I was looking for something a little
17 deeper than that. That's a good start, though.

18 Q Is it fair to say that you believe the term
19 "layer" requires different materials? Each layer
20 needs to be a different material from other layers 11:04:55
21 because that's the construction that your counsel
22 gave to you, right?

23 A Correct.

24 MR. PETROFF: Objection. Mischaracterizes.

25 /////

1 BY MR. BREGMAN:

2 Q Is there anything in the patent that defines
3 the term "layer"?

4 MR. PETROFF: Objection. Form.

5 THE WITNESS: Look at my paragraph 136. 11:05:17

6 BY MR. BREGMAN:

7 Q Okay. I'm looking at the paragraph.

8 A I'm sorry?

9 Q You said I should look at the paragraph, so
10 I've looked at it. 11:06:27

11 A Yeah. It says -- it says:

12 "The claims of the '683 patent
13 disclose four layers specifically
14 described in the specification as
15 different, having four different mean 11:06:39
16 compositions and four different
17 names."

18 Q Okay. So let's talk about the four different
19 names. So does interdiffusion, intermediate,
20 intermetallic, and superficial -- sorry. Let me say 11:06:57
21 that again.

22 Does interdiffusion layer, intermediate
23 layer, intermetallic layer, and superficial layer,
24 are those terms of art that are known in the
25 industry? 11:07:12

Page 104

1 MR. PETROFF: Objection. Form.

2 THE WITNESS: I think each company probably
3 has its own description.

4 BY MR. BREGMAN:

5 Q So those are not -- I can't go to a 11:07:24
6 metallurgy handbook and look up the meaning of an
7 interdiffusion layer and it will tell me; is that
8 right?

9 A That one is general enough that that would
10 probably be okay. 11:07:54

11 Q What do you mean, "be okay"?

12 A I mean, you could find that in a general
13 metallurgical text or --

14 Q So there would be a textbook that
15 specifically says an interdiffusion layer? 11:08:05

16 A Yeah.

17 Q And a person of skill in the art at the time
18 in early 2006, if I told them I've got a metal with
19 an interdiffusion layer, they would know exactly
20 what I was talking about, right? 11:08:22

21 MR. PETROFF: Objection to form. Calls for
22 speculation.

23 THE WITNESS: Yeah, I -- I would think so,
24 but --

25 /////

1 BY MR. BREGMAN:

2 Q So you think that's a term of art, basically?

3 A Yes.

4 Q And what about intermediate layer, that's a

5 term of art too, right? 11:08:36

6 A Yes.

7 Q A person of skill in the art would

8 immediately know what an intermediate layer is?

9 MR. PETROFF: Objection, form.

10 BY MR. BREGMAN: 11:08:48

11 Q Is that right?

12 A I can't answer. I don't -- I don't know.

13 Q Are you providing an opinion as a person of

14 ordinary skill in the art?

15 A Yes. 11:08:59

16 Q And as a person of ordinary skill in the art,

17 prior to October of 2006, if you heard the word

18 "intermediate layer," would you know what that is?

19 MR. PETROFF: Objection, form.

20 THE WITNESS: What I do know is in the 11:09:14

21 Kefferstein patent, those terms were not used.

22 BY MR. BREGMAN:

23 Q That's one patent. I'm asking you as a

24 person of ordinary skill in the art, at the time of

25 the invention, if I asked you what those terms mean, 11:09:41

Page 106

1 would you know what those terms mean?

2 MR. PETROFF: Objection, form. Asked and
3 answered.

4 THE WITNESS: Yes, I think -- I think a
5 person of ordinary skill in the art would have an 11:10:09
6 idea what those terms mean.

7 BY MR. BREGMAN:

8 Q And they would know that because the word
9 "intermediate" has a meaning, right?

10 A Yes.

11 Q What is the meaning of the word
12 "intermediate"?

13 A Something between two boundaries, between two
14 end points.

15 Q So intermediate is something between two 11:10:45
16 other things, right?

17 A Yes.

18 Q And what about intermetallic, what does
19 intermetallic mean?

20 A That is a volume that is going to be rich in 11:10:56
21 intermetallic compounds.

22 Q And intermetallic means there is a mixture of
23 different metals, right?

24 A It's a compound.

25 Q A compound of different metals? 11:11:13

Page 107

1 A Right.

2 Q And superficial, what does superficial mean?

3 A It means bordering on the external surface.

4 Q And what does interdiffusion mean?

5 A That there is a cross-current diffusion field 11:11:27
6 going on.

7 Q There's one material diffusing into another
8 material?

9 A Right.

10 Q And if I asked you before you saw this patent 11:11:51
11 what an interdiffusion layer is, you would tell me
12 it means what?

13 MR. PETROFF: Objection, form. Calls for
14 speculation.

15 THE WITNESS: It would be a solid solution 11:12:05
16 where iron would be moving in one direction and
17 aluminum would be moving in the other direction.

18 BY MR. BREGMAN:

19 Q You wouldn't know if it was iron and aluminum
20 from the words "interdiffusion," right? 11:12:21

21 A No, no. Not just from the words, no.

22 Q So interdiffusion layer would mean one
23 material diffusing into another material?

24 A Yes.

25 Q To form a layer? 11:12:31

Page 108

1 A Yes.

2 MR. PETROFF: Objection. Form.

3 BY MR. BREGMAN:

4 Q And what about intermediate layer, what would
5 that mean before you read this patent to a person of 11:12:38
6 ordinary skill in the art?

7 MR. PETROFF: Objection, form. Calls for
8 speculation.

9 BY MR. BREGMAN:

10 Q I believe you said intermediate is between 11:12:47
11 two other things. So this would be a layer between
12 two other layers, right?

13 A It would be a boundary between the
14 interdiffusion layer and the intermetallic layer.

15 Q And the intermetallic layer, you said earlier 11:13:01
16 intermetallic is a compound of two different metals.
17 So this would be a layer that contains a compound of
18 two different metals?

19 A There might be a matrix there too. It could
20 be a series of compounds in a matrix. 11:13:19

21 Q Okay. And a superficial layer, that would
22 just be the layer on the outer surface, right?

23 A Right.

24 Q And this paragraph you were talking about a
25 moment ago, which is paragraph 136, you said 11:13:34

Page 109

1 Figure 1 and the claims of the '683 patent disclose
2 having four different mean compositions.

3 Do you see that?

4 A Yes.

5 Q So you say Figure 1 discloses it, so let's 11:13:48
6 start with that.

7 So if we look at Figure 1, how do you know
8 that Figure 1 has got four different mean
9 compositions?

10 A If we go to the patent -- 11:14:02

11 Q Well, you don't say the patent. You say
12 Figure 1 in the claims. I'm asking you about that.
13 You say Figure 1 in the claims. I'd like to know
14 how Figure 1 discloses four different mean
15 compositions. 11:14:48

16 A Was that at 136?

17 Q Uh-huh.

18 A Paragraph 136?

19 Q That's right.

20 A Just give me a second. 11:16:02

21 Okay, go to Column 12, line 57.

22 Q Okay.

23 A Of the patent.

24 Q I see that. What about it?

25 A You see the mean compositions? 11:17:29

Page 110

1 Q In this particular example?

2 A Yes.

3 Q So are you saying the patent only covers this
4 one example?

5 A Well, this is -- 11:17:44

6 MR. PETROFF: Objection.

7 Mischaracterization.

8 BY MR. BREGMAN:

9 Q Go ahead, Dr. DeArdo.

10 A Well, this is one example where it's shown. 11:17:51

11 Q Are there any other examples in the patent
12 where different compositions are provided for each
13 of the layers?

14 MR. PETROFF: Objection, form.

15 THE WITNESS: I don't -- I don't see any 11:18:07
16 others.

17 BY MR. BREGMAN:

18 Q Okay. So if you read on line 61, it says --
19 it starts listing the layers. And it says "an
20 interdiffusion layer or an intermetallic layer." 11:18:31

21 Do you see that?

22 A Yes.

23 Q So it's using the word "intermetallic" layer
24 instead of using "interdiffusion" layer for the same
25 layer, right? 11:18:51

Page 111

1 MR. PETROFF: Objection.

2 Mischaracterization.

3 BY MR. BREGMAN:

4 Q What does it mean by interdiffusion layer or
5 intermetallic layer? 11:18:58

6 A We're in Example 2, right?

7 Okay, I'm sorry. Repeat the question.

8 Q So on line 61 you told me that because
9 different names are used for each of the layers,
10 that's one of the reasons why you can tell that they 11:19:40
11 have different compositions. But I see here for (a)
12 it seems to be using the word interdiffusion layer
13 and intermetallic layer simultaneously; is that
14 right?

15 MR. PETROFF: Objection. 11:19:54
16 Mischaracterization.

17 THE WITNESS: That's what it says.

18 BY MR. BREGMAN:

19 Q Okay. So the words interdiffusion and
20 intermetallic can be used interchangeably in this 11:20:02
21 example; is that right?

22 MR. PETROFF: Objection.

23 Mischaracterization. Calls for speculation.

24 THE WITNESS: I can't interpret that. I
25 do -- I do notice the hardness variation, the HV50g. 11:20:17

Page 112

1 BY MR. BREGMAN:

2 Q The hardness variation between what?

3 A In that area where these one or two layers
4 are.

5 Q So you've got -- the very next sentence says: 11:20:38

6 "This layer is itself composed of
7 two sublayers."

8 Do you see that?

9 A So -- yes.

10 Q So the interdiffusion layer or intermetallic 11:20:50
11 layer, which I think it's referring to the same
12 thing -- correct me if I'm wrong -- can be divided
13 up or composed of two sublayers; is that right?

14 MR. PETROFF: Objection.

15 Mischaracterization. 11:21:03

16 THE WITNESS: I presume that's what they're
17 saying.

18 BY MR. BREGMAN:

19 Q And that's the embodiment you're saying is
20 covered by the claims, right? 11:21:10

21 A Yes.

22 MR. PETROFF: Objection.

23 Mischaracterization.

24 BY MR. BREGMAN:

25 Q Are there any other reasons why you believe 11:21:23

Page 113

1 that the claims -- that different layers required --
2 that each layer has to have a different mean
3 composition from every other layer?

4 A Well, that's the way the layers were defined
5 in the patent. 11:21:43

6 Q Is there a difference between the words
7 "composition" and "mean composition"?

8 A Repeat that, please.

9 Q Is there a difference in meaning between the
10 words "composition" and "mean composition"? 11:22:03

11 A Mean composition would be an average
12 composition over a certain distance. Whereas a
13 composition would be a composition at a location.

14 Q So if we go to page -- sorry -- paragraph 68
15 on page 31 of your second declaration. 11:22:35

16 A 68 and 31?

17 Q Uh-huh.

18 A Okay.

19 Q Is that the definition of layers that you've
20 applied or that you've used in forming your opinions 11:22:53
21 in this proceeding?

22 A Yes.

23 Q Does that definition say anything about
24 different mean compositions?

25 A The key word is "materials." 11:23:05

1 Q So you're saying that every layer in the
2 four-layered structure needs to have a different
3 material from every other layer?

4 A Yes.

5 Q What do you mean by "spread over the base 11:23:29
6 steel"?

7 A Covering.

8 Q Like the verb, you spread it over the base
9 steel?

10 A Like what? 11:23:46

11 Q Like peanut butter, you spread peanut butter
12 on your bread?

13 A First of all, you put the peanut butter down
14 and then you put the jelly down, right? You have
15 two layers. 11:24:02

16 Q So you spread the peanut butter down and you
17 spread the jelly down?

18 A Right.

19 MR. PETROFF: Objection.

20 BY MR. BREGMAN: 11:24:09

21 Q And that's how these layers are spread onto
22 the base steel?

23 A I think that's the description of how they
24 appear, yes.

25 Q The description in the patent? 11:24:15

Page 115

1 A I don't know if it's described like that in
2 the patent.

3 Q Would you be surprised if the word "spread"
4 doesn't show up in the patent?

5 A I think the use of "spread" was a term of art 11:24:40
6 to describe where it was or how it was related to
7 the steel substrate. Covering.

8 Q Each of those layers only occur when you heat
9 the coated product?

10 You have a precoated product, right, so 11:25:14
11 that's got a coating on it?

12 A Yes.

13 Q Which is a single layer. And then you heat
14 it up. And when you heat it, that single layer
15 diffuses with the base steel and turns it into four 11:25:24
16 different layers, right?

17 MR. PETROFF: Objection. Mischaracterization
18 of the patent.

19 BY MR. BREGMAN:

20 Q Is that correct?

21 A Correct.

22 Q So --

23 A As I understand it.

24 Q So the only layer that is actually placed or
25 spread on the base steel is the precoating, right? 11:25:43

Page 116

1 A Yes.

2 Q And when you say each layer has to have a
3 different material from every other layer, do you
4 mean that the phases need to be different?

5 MR. PETROFF: Objection. Beyond the scope of 11:26:05
6 direct.

7 THE WITNESS: I'm just following the
8 guidelines that layers mean materials. Different
9 layers mean different materials.

10 BY MR. BREGMAN: 11:26:25

11 Q So if I look at Column 10, for example, line
12 29, and it says:

13 "At the time of thermal
14 treatment, the base coating, of
15 aluminum, for example, is transformed 11:26:52
16 into a layer alloyed with iron and
17 comprising different phases depending
18 on the thermal treatment and having
19 considerable hardness which may exceed
20 600 HV50g." 11:27:08

21 Do you see that?

22 A I'm sorry. What was the question?

23 Q The question was, when you are talking about
24 having each layer being a different material, I
25 pointed you to the patent where it talks about 11:27:27

Page 117

1 having different phases, and I wanted to know if
2 that means the same thing to you.

3 MR. PETROFF: Objection. Beyond the scope of
4 direct.

5 THE WITNESS: Yes, I don't know the 11:27:38
6 relationship between layers and phases. They could
7 be related, but I haven't looked into that.

8 BY MR. BREGMAN:

9 Q So when the patent talks about transforming
10 the precoating into different phases using this 11:27:55
11 thermal treatment, is that different from what you
12 are saying with the word "layer"?

13 MR. PETROFF: Objection, form. Beyond the
14 scope of direct. Asked and answered.

15 THE WITNESS: I have no opinion. 11:28:15

16 BY MR. BREGMAN:

17 Q So you have no opinion that when the patent
18 is talking about different phases, that's talking
19 about the different layers?

20 MR. PETROFF: Objection. Asked and answered. 11:28:26

21 THE WITNESS: Yes, because your question is
22 implying that there's a relationship between phases
23 and layers, and I don't know that.

24 BY MR. BREGMAN:

25 Q I'm just reading what the patent says. So 11:28:42

Page 118

1 maybe you can tell me what it means when it says
2 that:

3 "At the time of thermal
4 treatment, the base coating of
5 aluminum, for example, is transformed 11:28:49
6 into a layer alloyed with iron and
7 comprising different phases."

8 What does that mean to you?

9 A I -- I can't answer. I don't know when in
10 the process this is describing. 11:29:22

11 Q Well, it says at the time of thermal
12 treatment. That's when in the process?

13 MR. PETROFF: Objection, form.

14 THE WITNESS: That's when the -- that's when
15 the precoat first interacts with the steel. 11:29:36

16 BY MR. BREGMAN:

17 Q Okay. And what is different phases -- that's
18 got no relation to the layer?

19 A Well, it may be too early to have layers.

20 Q So what is a phase? 11:29:54

21 A It's a volume of homogenous composition,
22 crystal structure, and so forth.

23 Q Is it a material with a mean composition?

24 A And with a mean composition, yes.

25 Q And it says, "different phases," and they 11:30:17

Page 119

1 replaced "phases" with the material having the same
2 mean composition. That leads you to the same place
3 as your claim construction, right?

4 MR. PETROFF: Objection, form.

5 THE WITNESS: Well, if the new phase is an 11:30:30
6 intermetallic compound, it's going to be a part of
7 it. It's not going to be a coating.

8 BY MR. BREGMAN:

9 Q So you could have different phases in the
10 same layer? 11:30:41

11 A I mean, I don't know. I could imagine you
12 could.

13 Q But you told me, per your definition, that
14 each layer has to have a different mean composition.
15 So you could have different phases in the same layer 11:30:59
16 which have different mean compositions is what you
17 told me.

18 A No. What I'm saying -- what I'm saying is,
19 two different layers may have two different
20 structures and two different mean compositions. 11:31:12

21 Q So two different layers can have two
22 different mean compositions. I think we've
23 discussed that. What do you mean they can have
24 different structures?

25 A Yeah. One could be a solid solution of the 11:31:30

Page 120

1 atoms and one could be a solid solution plus
2 intermetallic compounds.

3 Now, the electron beam would go over there
4 and average out those compositions. So you could
5 compare the mean composition of layer X from the 11:31:59
6 mean composition of layer Y.

7 Q What do you mean electron beam could do that?
8 The electron beam in the SEM?

9 A Yes.

10 Q How does the SEM find out a mean composition? 11:32:15

11 A Well, it does it by back-scattered electron
12 approach.

13 Q So it shoots an electron at the surface?

14 A Right.

15 Q It comes back and it looks a different color 11:32:34
16 or shade to the human eye. How does that tell you
17 anything about mean composition? It might be, as
18 you showed me in Figure 2, multiple different
19 compositions in the same layer.

20 MR. PETROFF: Objection. 11:32:55
21 Mischaracterization.

22 THE WITNESS: I'm sorry. Repeat that.

23 BY MR. BREGMAN:

24 Q I'm trying to understand what you said. You
25 said a moment ago that the electron beam in a 11:33:06

1 scanning electron microscope can tell you the mean
2 composition of the material that it scanned. And
3 I'm trying to figure out how that works, because you
4 specifically told me with respect to Figure 2 that
5 you could have different materials mixed together. 11:33:23
6 And I'm not -- I'm just not understanding how the
7 electronic scanning microscope tells you what the
8 mean composition is.

9 MR. PETROFF: Objection.
10 Mischaracterization. 11:33:38

11 BY MR. BREGMAN:

12 Q I don't understand the mean composition.

13 A Well, the micros we're looking at are more or
14 less mean compositions. The microstructures,
15 Figure 1, Figure 2, Figure 22. 11:33:56

16 Q So you're saying the figures that we're
17 looking at, these micrographs, essentially show mean
18 composition -- you're saying that the micrographs
19 that we've been looking at, Figures 1, 2, and 22 of
20 Cornette, shows you mean composition? 11:34:17

21 A Yes.

22 Q How can you tell what a mean composition is
23 from looking at those images?

24 A Well, you -- you would have an independent
25 analysis run. 11:34:30

Page 122

1 Q So the SEM image that we're looking at gives
2 you colors or shades?

3 A Right.

4 Q But then you would take the material and do a
5 chemical composition? 11:34:44

6 A Right.

7 Q You would take a little bit of that material
8 and use whatever technique that you'd use,
9 chromatography or something, to try to figure out
10 what the material is? 11:34:56

11 A Yeah, EDS or something, right.

12 Q But the figures themselves don't show you a
13 mean composition?

14 A No. They don't read off a composition.

15 Q I see. But they show you materials that have 11:35:06
16 the same properties, which is likely the same
17 composition, by using different shades?

18 MR. PETROFF: Objection. Form.

19 THE WITNESS: Possible.

20 MR. BREGMAN: Why don't we take a break for 11:35:20
21 lunch. Maybe let's not go -- I know you're on the
22 East Coast. I don't want you to stay too late. So
23 maybe just a half an hour for lunch? Is that enough
24 for everyone?

25 MR. PETROFF: Doctor? 11:35:34

1 THE WITNESS: Sure, it's good.

2 MR. BREGMAN: So it's 11:35, so just five
3 minutes past the hour?

4 THE WITNESS: Okay.

5 MR. BREGMAN: Great. Thank you. 11:35:47

6 THE VIDEOGRAPHER: The time is 11:35 a.m. and
7 we are off the record.

8 (Lunch recess.)

9 THE VIDEOGRAPHER: The time is 12:12 p.m. and
10 we are back on the record. 12:12:33

11 BY MR. BREGMAN:

12 Q Dr. DeArdo, just checking again if you didn't
13 discuss your testimony with any counsel during the
14 break?

15 A No. 12:12:44

16 Q Okay. Why don't we turn back to the patent,
17 if you don't mind, and this time let's turn to
18 Column 15. You'll see round about line 20.

19 Are you there?

20 A I have to find it. 12:13:15

21 Q Okay. Tell me when you're there.

22 Are you there?

23 A One second. Okay.

24 I'm sorry, go ahead.

25 Q Okay. So on line 20 on Column 15, the 12:14:14

Page 124

1 beginning of those claims.

2 Do you see that?

3 A Yes.

4 Q And do you see there's the first claim, Claim

5 No. 1? Do you see that? 12:14:31

6 A Yes.

7 Q And it starts off by saying:

8 "A coated steel stamped product,

9 which comprises:"

10 Do you see that? 12:14:43

11 A Yes.

12 Q Do you know what that first part of the claim

13 is called?

14 MR. PETROFF: Objection. Beyond the scope of

15 direct. 12:14:49

16 THE WITNESS: It's part of the preamble.

17 BY MR. BREGMAN:

18 Q That's the preamble. And what is your

19 understanding of what a claim preamble is?

20 MR. PETROFF: Objection. Beyond the scope of 12:15:00

21 direct.

22 THE WITNESS: I'm not sure.

23 BY MR. BREGMAN:

24 Q Do you understand the meaning of the claim?

25 A Yes. 12:15:11

Page 125

1 Q Do you -- can you understand the claim
2 without that first preamble?

3 MR. PETROFF: Objection. Beyond the scope of
4 direct.

5 THE WITNESS: That first part is very 12:15:24
6 important because it sets the limits of what this
7 claim is covering.

8 BY MR. BREGMAN:

9 Q And is there anything in the rest of the
10 claim that tells you that the product is a coated 12:15:40
11 steel stamped product?

12 MR. PETROFF: Objection. Beyond the scope of
13 direct.

14 THE WITNESS: No, I don't see anything in
15 Claim 1 other than the preamble that mentions 12:16:07
16 stamping.

17 BY MR. BREGMAN:

18 Q If we go back to your declaration, paragraph
19 67.

20 A What page? 12:16:37

21 Q Page 31.

22 A Okay. Okay.

23 Q Paragraph 67 says:

24 "I've been instructed by counsel
25 that the preamble," open quotes, "a 12:16:57

Page 126

1 coated steel stamped product," close
2 quotes, "is a limitation of the claims
3 for purposes of anticipation and
4 obviousness."

5 Do you see that? 12:17:14

6 A Yes.

7 Q Do you have an independent belief whether or
8 not the preamble is a limitation of the claims?

9 MR. PETROFF: Objection. Beyond the scope of
10 direct. 12:17:27

11 THE WITNESS: I wasn't involved in claim
12 construction, so I can't -- I can't speculate.

13 BY MR. BREGMAN:

14 Q So you have no independent belief of whether
15 the preamble is a limitation of the claims other 12:17:47
16 than your counsel telling you that it is, right?

17 MR. PETROFF: Objection. Asked and answered.

18 BY MR. BREGMAN:

19 Q Sorry. Go ahead.

20 A Well, I mean, it's defining the universe of 12:17:59
21 the patent, a coated steel stamped product.

22 Q And what structure does the stamped part of
23 the preamble add to the claims body that is not
24 already there?

25 A That's its structure. It's something that 12:18:20

Page 127

1 has been stamped.

2 Q And -- but it doesn't mention that it means
3 stamped anywhere in the body of the claim, right?

4 MR. PETROFF: Objection to form.

5 THE WITNESS: No, I don't see it. 12:18:39

6 BY MR. BREGMAN:

7 Q In your previous answer, you said you do have
8 an independent belief that the limitation adds
9 something to the claims?

10 A Yes, I do. I think it helps define the claim 12:18:55
11 because it defines, I don't know, the field -- the
12 field of activity, a coated steel stamped product.

13 Q And if it just said "a steel product which
14 comprises," how would that change your understanding
15 of the claim? 12:19:17

16 MR. PETROFF: Objection. Calls for
17 speculation. Goes beyond the scope of direct.

18 THE WITNESS: Well, then we wouldn't be able
19 to talk about coating, which is, of course, a big
20 part of this. 12:19:32

21 BY MR. BREGMAN:

22 Q Would a product after stamping have the
23 four-layered coating recited in the claims?

24 A Repeat that again, please.

25 Q Would a product after stamping have the 12:19:47

Page 128

1 four-layered coating recited in the claims?

2 MR. PETROFF: Objection to form.

3 THE WITNESS: If it's done correctly, it
4 would.

5 BY MR. BREGMAN: 12:20:00

6 Q Would a product before stamping also have the
7 four-layer coating that is recited in the claims?

8 MR. PETROFF: Objection. Calls for
9 speculation. Objection, form.

10 THE WITNESS: No, it would not. 12:20:17

11 BY MR. BREGMAN:

12 Q Why is that?

13 A Because the coating at room temperature when
14 all is said and done is altered by the stamping.

15 Q So it's not the heating of the product to the 12:20:42
16 austenitizing temperature that creates the layers?

17 MR. PETROFF: Objection. Mischaracterizes
18 his answer.

19 THE WITNESS: The heating is important,
20 critically important, but it also has to be after 12:21:05
21 stamping.

22 BY MR. BREGMAN:

23 Q What has to be after stamping?

24 A Any observation, any analysis.

25 Q Of the steel? 12:21:15

Page 129

1 A Of the steel and the coating.

2 Q So it wouldn't really make sense that this
3 claim -- it wouldn't really make sense to determine
4 the characteristics of the products until after the
5 stamping and quenching has already happened, right? 12:21:36

6 MR. PETROFF: Objection, form.

7 THE WITNESS: Yes. The stamping process.

8 BY MR. BREGMAN:

9 Q And after it is cooled down, right? You
10 wouldn't want to determine the final characteristics 12:21:52
11 of a product without having the entire process
12 complete, which my understanding is it ends with
13 quenching; is that right?

14 MR. PETROFF: Objection, form.

15 THE WITNESS: At room temperature. 12:22:08

16 BY MR. BREGMAN:

17 Q After the stamping?

18 A After the stamping and quenching.

19 Q So after you apply the heat treatment,
20 including this critical heating rate that you just 12:22:37
21 mentioned, but before the stamping, would the
22 product still have the four-layer coating that is
23 recited in the claims?

24 MR. PETROFF: Objection. Calls for
25 speculation. Beyond the scope of direct. 12:22:52

Page 130

1 THE WITNESS: I -- I can't answer that. I
2 haven't looked into that.

3 BY MR. BREGMAN:

4 Q But the layers are created by the heating,
5 right? 12:23:04

6 MR. PETROFF: Objection.

7 THE WITNESS: Not only by the heating, but
8 also by the strain in the stamping.

9 BY MR. BREGMAN:

10 Q S-T-R-A-I-N. 12:23:18

11 A The deformation.

12 Q And also by the cooling?

13 A I -- I don't know about the cooling. I
14 haven't looked into that.

15 Q Okay. Let's switch gears a little bit here 12:23:28
16 and look at your paragraph starting with
17 paragraph 70 of your second declaration.

18 A Okay.

19 Q Now, we're talking about the Cornette
20 publication, Exhibits 1013, 1014, 1004. 12:24:20

21 Are you familiar with those exhibits?

22 A Yes.

23 Q And that's what you're referring to as
24 Cornette?

25 A Yes. 12:24:33

Page 131

1 Q And the last sentence of paragraph 70 says:
2 "My opinions in this declaration
3 are the same for each Cornette
4 Exhibit 1013, 14, 1004 and 2007, and I
5 refer to 1013 throughout my 12:24:48
6 declaration."
7 Do you see that?
8 A Yes.
9 Q So all the references are the same, they
10 contain the same descriptions, right? 12:25:00
11 MR. PETROFF: Objection.
12 Mischaracterization.
13 BY MR. BREGMAN:
14 Q Sorry. What was your answer?
15 A Correct.
16 Q And, now, Cornette, you're calling it
17 Cornette because the author's name is Cornette; is
18 that right?
19 A Yes.
20 Q I'm just going to open up that exhibit, which 12:25:15
21 is 1013. And I just want to go see the rest of the
22 authors.
23 I don't know if you've got that handy, but
24 I'll read them to you. D. Cornette,
25 C-O-R-N-E-T-T-E. T. Hourman, H-O-U-R-M-A-N, 12:25:43

Page 132

1 O. Hudin, H-U-D-I-N, J.P. Laurent, L-A-U-R-E-N-T,
2 and A. Reynaert, R-E-Y-N-A-E-R-T.

3 Do you see that?

4 A Yes.

5 Q Do you recognize this document as 12:26:10
6 Exhibit 1013 that we were just discussing as the
7 Cornette reference?

8 A Yes.

9 Q And I just read to you the list of authors.

10 A Yes. 12:26:31

11 Q Do you know any of those authors?

12 A No, I don't.

13 Q You've never spoken to any of them before?

14 A No.

15 Q Underneath their names it says, "Usinor 12:26:42
16 Research."

17 Are you familiar with that company?

18 A Yes. That's one of the French steel
19 companies that was absorbed into ArcelorMittal.

20 Q So is it safe to assume that Mr. Cornette, 12:26:58
21 Mr. Hourman, Mr. Hudin, Mr. Laurent, and
22 Mr. Reynaert were working at this French company
23 that is now ArcelorMittal?

24 A Yes.

25 MR. PETROFF: Objection. Calls for 12:27:13

Page 133

1 speculation.

2 BY MR. BREGMAN:

3 Q And is it safe to assume that this research
4 that they were doing was for this French company,
5 Usinor Research? 12:27:32

6 A Yes. I assume so, yes.

7 MR. PETROFF: Calls for speculation.

8 BY MR. BREGMAN:

9 Q And the second to last sentence of paragraph
10 71 -- 12:27:55

11 A In my declaration?

12 Q Your declaration.

13 A Okay.

14 Q We'll be moving between the two documents.

15 A It's quite okay. It's all right. 12:28:01

16 Q It says:

17 "In a section of Cornette
18 discussing mechanical characteristics
19 of Usibor, Cornette states that the,"
20 open quotes, "mechanical properties 12:28:24
21 after hot forming process are not
22 guaranteed (sic) by Usinor," period,
23 close quotes.

24 Do you see that?

25 A Yes. 12:28:38

Page 134

1 Q What is Usibor?

2 A Usibor? That's the steel -- that's the steel
3 we're talking about.

4 Q That's the steel that is the base steel used
5 in -- 12:28:53

6 A Yes, the boron steel, 22 MM B5.

7 Q Let's turn back to Cornette. That's
8 Exhibit 1013.

9 A Okay.

10 Q And I want to direct your attention at 12:29:25
11 Figure 21, which you'll find on page 9, POSCO
12 Exhibit 1013-0009.

13 A Yes, I have it.

14 Q What is the alloying reaction depicted and
15 labeled in Figure 21? 12:30:01

16 A It's not -- it's not specified.

17 Q So can you walk me through what you could
18 learn from that figure?

19 A Well, first of all, I think it's a very nice
20 figure. I like it. 12:30:28

21 Okay. It shows what the French call the
22 delivery system on the left, right? The precoated
23 Usibor 1500. That could be either hot rolled or
24 cold rolled. The difference being mainly in the
25 thickness. And then it's put in the furnace and 12:30:51

Page 135

1 heated to 800 to 950 C for five to 20 minutes,
2 during which this alloy reaction occurs on the
3 surface between the precoat and the steel.

4 Then it's transferred to the hot forming
5 press. You see the two dies there, right? The flat 12:31:25
6 sheet is converted into that -- that shape looks
7 like this cross-section of a gutter.

8 Q Uh-huh.

9 A That's called like an A pillar or B pillar,
10 body-in-white of the car where it is hot formed and 12:31:46
11 quenched by cooling in the die.

12 Q Would the alloy reaction be the same for all
13 of the values between 880 to 950 degrees C in five
14 to ten minutes?

15 MR. PETROFF: Objection. Calls for 12:32:37
16 speculation.

17 THE WITNESS: I can't really say because I
18 haven't studied this. I'd have to investigate this.

19 BY MR. BREGMAN:

20 Q Would a person of skill in the art who 12:32:58
21 planned to reproduce this figure, would they have
22 tried these different values that are described
23 here, five to ten minutes in the furnace at 880 to
24 950 degrees C?

25 MR. PETROFF: Objection. Incomplete 12:33:19

1 hypothetical. Foundation.

2 THE WITNESS: I can't answer that. Possibly.

3 All those temperatures are above -- all these

4 temperatures are above 880 centigrade, which is

5 above A3 temperature, which means it's in the 12:33:45

6 austenite single phase field.

7 BY MR. BREGMAN:

8 Q So what does it mean in that yellow oval that

9 says:

10 "Heating 5-10 minutes 880 to 950 12:34:03

11 degrees C."

12 What does the heating mean?

13 A That's the soaking time at temperature.

14 Q And then what does it mean -- another oval

15 where it says "Quenching," what is that? 12:34:21

16 A You see just down below it says, "cooling in

17 the die"?

18 Q Uh-huh.

19 A So it's die quenched.

20 Q So earlier you had used the term 12:34:32

21 "thermomechanical treatment."

22 Do you remember that?

23 A Yes.

24 Q So what is the thermomechanical treatment

25 that's shown in this figure? 12:34:43

Page 137

1 MR. PETROFF: Objection. Calls for
2 speculation. Foundation.
3 BY MR. BREGMAN:
4 Q Does this figure show thermomechanical
5 treatment? 12:34:53
6 A In a sense, yes.
7 Q And what --
8 A In a sense it's high temperature deformation.
9 Q And what is the thermomechanical treatment in
10 charge of? 12:35:05
11 A It's strain being applied to the austenite at
12 a high temperature.
13 Q So the thermomechanical treatment is just
14 what is happening during the press; is that right?
15 A Yes. 12:35:18
16 Q And that's separate from heating and the
17 quenching?
18 A Yes.
19 Q Where this reference talks about -- just
20 above this figure, second line of the paragraph 12:35:35
21 above this figure, it says:
22 "In-use properties such as high
23 mechanical characteristics are
24 obtained through heat treatment or hot
25 forming." 12:35:51

Page 138

1 Do you see that?

2 A Yes.

3 Q So is it using the term "heat treatment" as a
4 synonym of hot forming?

5 A No, no. This -- this starting condition on 12:35:59
6 the left could be related to this treatment in the
7 oval, the second one, the alloying reaction. Okay?

8 Q Uh-huh.

9 A And then quenched in the water without the
10 deformation. That would be a heat treatment. 12:36:22

11 The difference is you don't get a shape out
12 of this. And you don't get a refinement of the
13 austenite grain structure due to the hot
14 deformation.

15 Q Are those the characteristics that you want 12:36:46
16 for the steel?

17 A Yes.

18 MR. PETROFF: Objection, form.

19 BY MR. BREGMAN:

20 Q So if we look at page 10, under Figure 22 12:37:01
21 there's a paragraph that talks about mechanical
22 characteristics.

23 Do you see that?

24 A Yes.

25 Q And then it says: 12:37:12

Page 139

1 right? Because that's going to be the final product
2 that you put in the vehicle?

3 A Exactly.

4 Q Automobile.

5 A It keeps you alive when you have a crash. 12:38:24

6 Q And then the following column after that, at
7 the bottom of the page it talks about painted parts.

8 Do you see that?

9 A Repeat that question, please.

10 Q So the next column, we were just reading in 12:39:02
11 one column. Go over another column and at the
12 bottom of that column, it's got a heading that says,
13 "Painted Parts."

14 A Yes, yes, yes. Right.

15 Q Then it says "Test", a column for "Test," a 12:39:14
16 column for "Results," and a column for "Method."

17 And for "Test" it says, "Material after of
18 cataphoretic," C-A-T-A-P-H-O-R-E-T-I-C, "paint."

19 Do you see that?

20 A Yes. 12:39:38

21 Q Do you have any idea what cataphoretic paint
22 is?

23 A Yes. It's a pretreatment for painting.

24 Q And you put those pretreatments after you
25 finish the stamping or before you finish -- 12:39:54

Page 141

1 A No, no. This is at the end.

2 Q So after you finished all the stamping, the
3 quench, maybe the parts have been cooled down to
4 room temperature, then you would apply the
5 cataphoretic paint? 12:40:09

6 A Right, right. Then they get welded into the
7 body-in-white, then the whole body-in-white is
8 dumped into an electrolytic bath for painting.

9 Q Is it your opinion that -- and this is an
10 ArcelorMittal article. So is it your opinion that 12:40:33
11 ArcelorMittal hot stamping is part of the heat
12 treatment of Usibor, U-S-I-B-O-R, 1500?

13 MR. PETROFF: Objection. Mischaracterizes.
14 Calls for speculation.

15 THE WITNESS: Ask me that again. I'm not 12:40:56
16 quite following what you want.

17 BY MR. BREGMAN:

18 Q So is the hot stamping part of the heat
19 treatment or not?

20 A It's part of the process. It's part of the 12:41:08
21 process.

22 Q It's part of the heat treatment process?

23 A No. It's its own process.

24 Q So you -- you are telling me that you and
25 Americans maybe would not use the term "heat 12:41:26

Page 142

1 treatment" when you're talking about stamped -- hot
2 stamped parts?

3 A Look at the caption of Figure 21.

4 Q Okay.

5 A Okay? 12:41:44

6 Q Yes.

7 A It says:

8 "Process used for the hot forming
9 of Usibor 1500 precoated."

10 That tells you everything. 12:41:55

11 Q So the process for hot forming includes the
12 heating?

13 A Yes.

14 Q So you've got a heating step that forms part
15 of overall hot forming? 12:42:12

16 A Sure. You have to get it up to the
17 temperature, 900 C or so.

18 Q And part of a heat treatment is also going to
19 include cooling?

20 MR. PETROFF: Objection, form. 12:42:23

21 THE WITNESS: Well, a heat treatment would
22 have a heating stage also, but no deformation stage.

23 BY MR. BREGMAN:

24 Q The heat treatment would include heating and
25 cooling; is that right? 12:42:42

1 A Yeah. There might be a small holding period
2 at the peak.

3 Q Right.

4 A Austenite doesn't just form instantaneously.

5 Q Sure.

6 A It's a diffusion process, so it might take
7 five minutes or two minutes or ten minutes,
8 depending on the size of the furnace and all that.

9 Q Sure. Why don't we look at Figure 22.

10 A Okay. 12:43:07

11 Q And it's got a figure on the top and then
12 it's got a figure on the bottom.

13 A Yes.

14 Q And the figure on the top is another one of
15 those micrograph cross-sections that we saw earlier, 12:43:18
16 similar to the one we saw earlier, right?

17 A Right.

18 MR. PETROFF: Objection, form.

19 BY MR. BREGMAN:

20 Q And the one on the bottom also appears to be 12:43:28
21 a micrograph, but this time maybe from the top down?
22 It's not clear to me.

23 A No, that's right, it is from the top down.

24 Q Okay. And on these micrographs it's got some
25 dates, right? It's got a date at the top left that 12:43:53

Page 144

1 says 2-01-1999?

2 A Yes.

3 Q That, I assume, is the date this image was
4 taken?

5 A I presume, yes. 12:44:04

6 Q And then at the bottom it's got a slightly
7 different scale to the ones we were looking at
8 earlier. Here we've got a 20 micrometer scale,
9 right?

10 A Yes.

11 Q And this one doesn't -- it does seem to
12 have -- it also has kilovolts there. This is 10
13 kilovolts?

14 A Right.

15 Q And it says something "Alusi," A-L-U-S-I, 12:44:28
16 next word, "TTH," space, forward slash, "3C."

17 Do you have any idea what that means?

18 A Is this -- is this on the bottom one?

19 Q They both have got the Alusi forward slash --
20 both Alusi/TTH. The top one has got the forward 12:44:56
21 slash 3C. The bottom one doesn't have the forward
22 slash 3C and it has the slash in a different place.

23 A Yeah, TTH/3C. Alusi. Yeah, Alusi -- I don't
24 know what that is, whether that's a sample number or
25 what. 12:45:24

Page 145

1 Q And then on the right side it says,

2 "Sollac-CRPC."

3 Any idea what that is?

4 A Yeah. Sollac was -- I think Sollac -- I'm

5 speculating here. I think Sollac was the research 12:45:40
6 arm of Usinor.

7 Q Okay. And then on the bottom image under the
8 date, it says, "Zone Marron Degraisse," Z-O-N-E,
9 next word, M-A-R-R-O-N, and underneath it, another
10 word, D-E-G-R-A-I-S-S-E. 12:46:12

11 Do you have any idea what that means?

12 A No. I'd need a French translation.

13 Q You said you needed a French translation?

14 A Right.

15 Q These -- again, these were tests in a French 12:46:32
16 facility, probably in the Sollac facility, the
17 predecessor to ArcelorMittal, right?

18 MR. PETROFF: Objection. Calls for
19 speculation.

20 BY MR. BREGMAN: 12:46:47

21 Q Sorry. We didn't hear your answer.

22 A Yes, I think these -- these were done at a
23 different site from where the steels were made and
24 rolled.

25 Q I see. And if we look at the top figure, 12:47:00

Page 146

1 would you agree that it shows different colored
2 bands, horizontal bands?

3 MR. PETROFF: Objection, form.

4 THE WITNESS: There's -- there's not a lot of
5 documentation here as to what we're looking at. You 12:47:28
6 do see a striation, and I know certain people want
7 to read an awful lot into this, but I have my
8 doubts.

9 BY MR. BREGMAN:

10 Q Just looking at the picture, the top diagram 12:48:07
11 of Figure 22 --

12 A That's right.

13 Q -- and I'm going to stay away from the word
14 "layers," because I realize it's a loaded term. I
15 just want to know if you can see in the figure 12:48:09
16 different colored horizontal bands sprouting out
17 what is presumably a base steel and going up?

18 MR. PETROFF: Objection, form.

19 THE WITNESS: Possibly.

20 BY MR. BREGMAN: 12:48:23

21 Q Why do you say "possibly"? I'm just asking
22 about the different colors. I'm not --

23 A I know. I know what you're asking. What I
24 don't know is how many times has this micro been
25 reproduced. 12:48:52

Page 147

1 You know, there's so many variables that go
2 into the image quality of a back-scattered electron
3 SEM. And unless there is documentation along with
4 it, it's difficult to really say with any certainty.

5 Q I'm just asking you looking at the 12:49:22
6 figure that you see --

7 A I know what you're asking, yes.

8 Q I'm not asking about some other figure that
9 may have better quality or worse quality. I'm just
10 saying the image that you're looking at -- 12:49:41

11 A Right.

12 Q -- can you tell that there are different
13 horizontal bands having different shades?

14 MR. PETROFF: Objection, form. Objection,
15 asked and answered. 12:49:57

16 THE WITNESS: Well, I think the point is,
17 this -- if this were a paper submitted to a
18 peer-reviewed journal, they would have to define
19 what is in those different colored bands. They
20 couldn't just show it. It declares something. You 12:50:20
21 see what I mean?

22 BY MR. BREGMAN:

23 Q Let me reread that.

24 "I think the point is if this
25 were a paper submitted to a 12:50:39

Page 148

1 peer-reviewed journal, they would have
2 to define what is in those different
3 colored bands."

4 A Exactly, exactly.

5 Q I'm not asking about a peer-reviewed journal. 12:50:47
6 If I took a kindergarten kid and I showed them this
7 picture, and I said, "Do you see different color
8 bands? Starting at the bottom going to the top, do
9 you see different colored bands?"

10 MR. PETROFF: Objection, foundation. 12:51:01

11 BY MR. BREGMAN:

12 Q I assume he would tell me yes.

13 So I'm asking you -- not whether it's peer
14 reviewed, not what the materials are in the bands,
15 none of that. I'm not even calling it layers. I'm 12:51:09
16 just asking you, do you see different colored bands
17 starting at the bottom and going from the bottom to
18 the top in this figure?

19 MR. PETROFF: Objection, form.

20 THE WITNESS: I think it's -- I think it's 12:51:20
21 difficult, because we don't know what we're looking
22 at.

23 BY MR. BREGMAN:

24 Q So you can't trust your eyes when it shows
25 you two different colors? 12:51:33

Page 149

1 MR. PETROFF: Objection --

2 THE WITNESS: No, you can trust your eyes.

3 BY MR. BREGMAN:

4 Q So as you sit here today, you cannot tell me,
5 looking at this Figure 22 of Cornette, whether it 12:51:44
6 shows different colored bands going from the bottom
7 of the micrograph towards the top?

8 MR. PETROFF: Objection, form.

9 THE WITNESS: I don't know what to say. I
10 think -- I think a third grader could look at this 12:52:17
11 and say there are different colored bands. Now,
12 what that actually means in the real world could be
13 very different.

14 BY MR. BREGMAN:

15 Q You'd agree that a third grader looking at 12:52:39
16 this would agree that there are different colored
17 bands going from the bottom of the figure or the
18 micrograph to the top of the figure or the
19 micrograph?

20 A Yes. 12:52:51

21 MR. PETROFF: Objection.

22 Mischaracterization.

23 BY MR. BREGMAN:

24 Q And a third grader, if I said to them, "Could
25 you identify different layers" would also be able to 12:52:56

Page 150

1 do that based on the colors in this diagram, right?

2 MR. PETROFF: Objection.

3 Mischaracterization.

4 THE WITNESS: Yes.

5 BY MR. BREGMAN: 12:53:07

6 Q Sorry. What was your answer?

7 A A third grader might do it, but I wouldn't do
8 it.

9 Q So a third grader would be able to look at
10 this and say that they could see different layers 12:53:17
11 from the top -- from the bottom of the micrograph to
12 the top, observing the different colors of the
13 horizontal bands?

14 A But, of course, a third grader doesn't
15 recognize how complicated this is. 12:53:31

16 Q I'm just talking about the figure. A third
17 grader looking at the micrograph and the top
18 micrograph of Figure 22 of Cornette, if I asked them
19 to identify different layers starting at the top and
20 going up, they would be able to identify four 12:53:47
21 different layers based on the different horizontal
22 bands that are depicted in this photograph, right?

23 MR. PETROFF: Objection, form.

24 THE WITNESS: Okay, yes, someone could see
25 different colored bands. 12:54:05

Page 151

1 BY MR. BREGMAN:

2 Q But you can't see different colored bands?

3 A I would be worried about this. If I were
4 doing this work, if someone were relying on me to
5 tell the truth, I would worry about that. 12:54:24

6 Q So you cannot tell different colored bands by
7 looking at --

8 A What I'm saying is, you can't believe the
9 gray tone.

10 Q Okay. But a third grader would be able to 12:54:35
11 look at it and distinguish different grades of
12 color?

13 A Yes, yes. And someone searching for
14 differences would see it to.

15 Q Okay. So if the construction of a layer does 12:54:50
16 not require that every one of the layers has a
17 different material from one another, if a layer is
18 just a horizontal band -- just imagine that for a
19 moment -- would this figure show four layers?

20 MR. PETROFF: Objection, form. 12:55:11

21 THE WITNESS: Well, I mean, if we're going to
22 use that approach, then I would say that the second
23 and the fourth -- of your fourth layer look similar.
24 They might be the same.

25 /////

1 BY MR. BREGMAN:

2 Q So assuming that the construction of a layer
3 just means a horizontal band, would a person looking
4 at this figure, person with skill in the art with
5 that definition, with the definition I gave you, 12:56:17
6 just a horizontal band, would they be able to
7 identify four different layers?

8 MR. PETROFF: Objection, form. Beyond the
9 scope of direct.

10 BY MR. BREGMAN: 12:56:31

11 Q In Figure 22.

12 A Well, I would -- I mean, if I used that
13 approach, I could see three layers, not four.

14 Q How is that?

15 A Because, like I said, the second and the 12:56:45
16 fourth look similar.

17 Q You're not -- you're not accepting the
18 premise here. The premise is that the layers could
19 be the same material.

20 I've got a chocolate cake. I've got some 12:57:04
21 cake. I've got some cream. I've got some more cake
22 and some more cream. They're made from the same
23 material, but they're different layers. That's the
24 premise that we -- that I'm applying now. I want
25 you to believe -- to suspend your belief for the 12:57:20

Page 153

1 moment. And if I give you a construction -- just
2 like your counsel gave you a construction, I'm going
3 to give you a different construction. I'm going to
4 say each of the layers don't need to have a
5 different chemical composition. Would you be able 12:57:31
6 to identify four layers in this figure?

7 MR. PETROFF: Objection. Foundation and
8 incomplete hypothetical. Beyond the scope of
9 direct.

10 THE WITNESS: Yeah. I mean, like I said, I 12:57:43
11 could see three different layers.

12 BY MR. BREGMAN:

13 Q The reason you say three is because two of
14 the layers are made from the same material?

15 A Because two of them have the same shading. 12:57:54

16 Q And if I had a chocolate cake with regular
17 chocolate cake and cream the next layer and
18 chocolate cake again and cream the next layer, the
19 chocolate cake is the same in alternate layers and
20 the cream is the same in alternating layers, you 12:58:14
21 would not say it's a four-layer cake? It's a
22 two-layer cake using your definition; is that right?

23 MR. PETROFF: Objection, form.

24 THE WITNESS: I don't know. I might eat the
25 cake. 12:58:26

1 BY MR. BREGMAN:

2 Q But you'd appreciate that there are four
3 layers, even though some of the layers are the same?

4 I understand that's not your definition of
5 layer, but I just want to stay with my definition of 12:58:33
6 layer. Can you see four layers in Figure 22?

7 A I told you I could see three.

8 Q Because you are saying two of the colors look
9 the same?

10 A Right. 12:58:48

11 Q Despite the fact that they're separated by a
12 layer of a different color?

13 A Right.

14 Q Okay. Now, we can't do anything else on
15 layers because you've eaten the cake. Let's move 12:59:08
16 on.

17 A Sorry.

18 Q So let's look at paragraph 204.

19 A Okay. In my declaration?

20 Q Yes, yes. 12:59:50

21 A Okay.

22 Q You say here:

23 "The amount of time to take a
24 coated steel blank from the furnace to
25 a die can vary. For example, a setup 01:00:09

Page 155

1 could take three minutes to get to the
2 blank from the furnace to the die."

3 Do you see that?

4 A Yes.

5 Q Where did you get that three minutes from? 01:00:15

6 A Just from experience in the lab. And looking
7 at photos from real stamping operations.

8 Q So you stand by that statement that the
9 typical time from a blank leaving a furnace to get
10 to a stamping die is typically three minutes; is 01:00:42
11 that right?

12 A Yes.

13 MR. PETROFF: Objection. Mischaracterize his
14 statement.

15 THE WITNESS: It could be. Could be. 01:00:51

16 BY MR. BREGMAN:

17 Q Or it could be 20 minutes? I mean, what if
18 the -- from a person of skill in the art's
19 standpoint, what do you understand to be the typical
20 amount of time that it would take for a blank to 01:01:02
21 leave a furnace and be placed in a die?

22 A I would say something on the order of a
23 minute or two or three.

24 Q If you look at Exhibit 1005, it's the Somani
25 reference, S-O-M-A-N-I. 01:01:42

Page 156

1 Do you recognize this document?

2 A Yes.

3 Q This is what you referred to in your
4 declaration as Somani?

5 A Yes. 01:02:14

6 Q And if we look at page 5, bottom right-hand
7 corner page 5 --

8 A What is it? 364?

9 Q 365.

10 A 365. Okay. 01:02:48

11 Q And you'll see in the first column, second to
12 last paragraph that starts with "Under continuous
13 deformation"?

14 A Yes.

15 Q And then you'll see a little bit down, it's 01:03:05
16 got a bolded Figure 7?

17 A Yes.

18 Q And then it says:

19 "In consistence, the absence of
20 any significant martensite formation 01:03:16

21 was also supported by the observation
22 that the cooling rate remained

23 constant down to 200 degrees C,

24 contrary to the case where the cooling

25 of austenite took place without prior 01:03:30

Page 157

1 deformation, while the cooling rate
2 decreased significantly as a
3 temperature of about 400 C was
4 reached, obviously due to the thermal
5 dissipation effects of martensite 01:03:45
6 formation."
7 Do you see that?
8 A Yes.
9 Q What does Somani mean here by:
10 "Obviously due to the thermal 01:03:52
11 dissipation effects of martensite
12 formation"?
13 MR. PETROFF: Objection. Calls for
14 speculation.
15 THE WITNESS: Yes. In -- when martensite 01:04:20
16 forms from austenite during cooling, the specimen
17 expands, as you can see in Figure 8. Okay?
18 BY MR. BREGMAN:
19 Q You're talking about the change in diameter?
20 A Right. 01:05:03
21 Q Uh-huh.
22 A And you can see when the strain is small,
23 there's very little change, but as the strain
24 increases, you see that we do get this large strain.
25 Q The strain being the EP equals 0.21? 01:05:24

Page 158

1 A Say it again?

2 Q Where are you looking at the strain?

3 Figure 9 or Figure 8?

4 A Yeah, I'm looking at Figure 8.

5 Q Okay. And where do you see the strain in 01:05:45
6 Figure 8?

7 A It's the change in the diameter.

8 Q Okay.

9 A Expansion, I should say.

10 Now, in Figure 9 those are -- those are 01:06:10
11 strain curves. There they're measuring the strength
12 of the steel. And so when the amount -- when the
13 amount of strain in forming is zero, we get a very
14 high strength after cooling to room temperature at
15 50 C a second. But as we deform more and more, as 01:06:48
16 you can see on the right side of Figure 8 --
17 Figure 9, I mean, I'm sorry -- we're getting more
18 and more strain-induced ferrite forming, which
19 means -- yeah, less and less martensite forming.

20 As the plastic strain at 800 C increases, 01:07:13
21 we're getting less and less martensite and more and
22 more ferrite. And the strength is falling.

23 What Somani was doing here is he was looking
24 at strain-induced ferrite, strain-induced ferrite
25 where it really shouldn't happen. Just about -- 01:07:57

Page 159

1 just near the A3 temperature.

2 Q Let's go back to paragraph 162 of your
3 declaration.

4 A Okay.

5 Q Let me know when you're there.

6 A Okay. I have it.

7 Q 162 says:

8 "Dependent Claim 11 recites:

9 "The coated steel stamped product
10 according to Claim 1, wherein said 01:09:14
11 layer (a) has a thickness less than 10
12 micrometers."

13 Do you see that?

14 A Yes.

15 Q So that is saying that the interdiffusion 01:09:29
16 layer should have a thickness less than 10
17 micrometers, right?

18 A Yes.

19 Q And you said earlier that the preamble should
20 be a part of the claim. The preamble is the coated 01:09:41
21 steel stamped product; is that correct?

22 A Yes.

23 Q So when it says that the Layer A has a
24 thickness of less than 10 micrometers, it means the
25 entire coated steel stamped product needs to have a 01:09:53

Page 160

1 thickness less than 10 micrometers. Is that what
2 you're saying?

3 A That's for Layer A.

4 Q Over the entire steel stamped product?

5 A Presumably. 01:10:07

6 Q Or just over some section of the stamped
7 steel product, as is showing in Figure 1?

8 A I can't say.

9 Q So you don't have an understanding of this
10 claim? 01:10:23

11 MR. PETROFF: Objection.
12 Mischaracterization.

13 THE WITNESS: I don't -- I don't understand
14 your question.

15 BY MR. BREGMAN: 01:10:28

16 Q Well, you've taken the position that the
17 preamble is the entire coated steel stamped product;
18 is that right?

19 MR. PETROFF: Objection.
20 Mischaracterization. 01:10:43

21 BY MR. BREGMAN:

22 Q Is that correct?

23 A Yes.

24 Q Okay. And when the claim says, "Wherein the
25 Layer A has a thickness less than 10 micrometers," 01:10:50

Page 161

1 does that mean the layer across the entire coated
2 steel stamped product or as what's shown in the
3 patent Figure A just in the section -- 150
4 micrometer section?

5 MR. PETROFF: Objection. Beyond the scope of 01:11:06
6 direct.

7 THE WITNESS: I can't answer that.

8 BY MR. BREGMAN:

9 Q Why not?

10 A Because I haven't seen any numbers. I 01:11:12
11 haven't seen any statistical distributions of
12 Layer A coating thickness. It's not --

13 Q It's not in the patent, is it?

14 Does it appear to you that the 10 micrometers
15 means to be over the entire stamped product on this 01:11:43
16 claim or some portion of the stamped product?

17 MR. PETROFF: Objection. Beyond the scope of
18 direct.

19 THE WITNESS: I would say the entire.

20 BY MR. BREGMAN: 01:12:00

21 Q If Layer A has a thickness of 11 micrometers,
22 10.5 micrometers, it wouldn't be covered under this
23 claim, right?

24 A It would be outside the requirement.

25 Q Even though if you're trying to control for 01:12:18

1 10 micrometers, you're going to have some variation
2 across the entire coated steel stamped product,
3 right?

4 A All I can say is what is said in the
5 documentation, and that is, it has to be less than 01:12:31
6 10.

7 Q So just to recap, what are the parameters
8 that one could change to affect the outcome of these
9 layers?

10 MR. PETROFF: Objection. Asked and answered. 01:12:57

11 BY MR. BREGMAN:

12 Q Could you affect the thickness of the layers
13 by the thickness of the original coating, the
14 precoating on the steel?

15 A I don't think so. 01:13:19

16 Q So if I had a 10-centimeter thick layer to
17 begin with, I could still have the same heating rate
18 and the same furnace temperature and same amount of
19 times involved, and I would still end up with the
20 thickness limitations of the claim? 01:13:46

21 MR. PETROFF: Objection. Foundation.
22 Incomplete hypothetical.

23 THE WITNESS: I mean, I don't know. I
24 haven't -- I haven't seen anyone do these
25 experiments. 01:13:58

Page 163

1 BY MR. BREGMAN:

2 Q Did you do any experiments to --

3 A No.

4 Q -- know if any of this could be done?

5 A No. 01:14:10

6 Q Why not?

7 A That wasn't part of my responsibility.

8 Q Are there experiments that could be done that
9 would verify that if you started with a different
10 thickness on the precoating, that would affect the 01:14:23
11 final thickness of the layers after stamping?

12 MR. PETROFF: Objection --

13 THE WITNESS: Why would anyone think that
14 would work?

15 BY MR. BREGMAN: 01:14:39

16 Q Why what would work?

17 A Changing the precoating thickness.

18 Q Well, isn't it logical that if you start with
19 a different precoated thickness, you'll end up with
20 different thicknesses post stamping? 01:14:49

21 A I don't see where that comes from.

22 Q So you think logically it doesn't make any
23 difference what precoating thickness you start with,
24 that will not affect the thickness of the layers?

25 A We're talking about the thermodynamic 01:15:05

Page 164

1 activities of the different atomic species in the
2 coating, in the precoating.

3 Q I see. So you're saying altering the
4 thickness of the precoating should not have an
5 effect on the thickness of the layers at the end of 01:15:29
6 the process; is that correct?

7 MR. PETROFF: Objection.
8 Mischaracterization.

9 THE WITNESS: Let me tell you what I really
10 think. I think to say that that is true is really a 01:15:39
11 problem.

12 BY MR. BREGMAN:

13 Q Why is that?

14 A Because there's no proof.

15 Q So you think that one could do 01:15:48
16 experimentation to prove it?

17 A I'm not saying that. I'm saying that as we
18 sit here today, there's no proof one way or the
19 other that that could work. The one thing we know
20 for sure is that the total coating thickness has to 01:16:07
21 be about 25 microns for corrosion resistance and
22 weldability.

23 Q Uh-huh.

24 A Now, going to thinner precoat is going in
25 the wrong direction. 01:16:24

Page 165

1 Q So how would you change the -- what
2 parameters would you change to affect the thickness
3 of the first layer?

4 MR. PETROFF: Objection. Beyond the scope of
5 direct. 01:16:40

6 THE WITNESS: Yeah, I -- I'd have to think
7 about that. That's a good question.

8 BY MR. BREGMAN:

9 Q Does the patent describe a different heating
10 rate or temperature ranges or any other parameters 01:16:48
11 to have a different thickness from Claim 1 to
12 Claim 11?

13 A The heating range is -- there are ranges for
14 heating range, right?

15 Q Right. 4 to 12 degrees C? 01:17:12

16 A Right, right, right.

17 Q So you think that adjusting the heating
18 rates, as long as it stays within that range, that
19 is what will give you the difference in thickness of
20 the interdiffusion layer between Claim 1 and 01:17:34
21 Claim 11?

22 MR. PETROFF: Objection, foundation.

23 THE WITNESS: Yeah, I -- I -- that might be a
24 place to start, but, I mean, I don't know if that
25 would work. 01:17:48

Page 166

1 BY MR. BREGMAN:

2 Q Does the patent tell you how to do that?

3 A The patent tells you how to get what is
4 required by following the instructions.

5 Q So if you follow the instructions and you've 01:18:06
6 got a 15 micrometer interdiffusion layer per
7 Claim 1, does the patent then tell you what you need
8 to change to get a 10 micrometer interdiffusion
9 layer per Claim 11?

10 MR. PETROFF: Objection. Beyond the scope of 01:18:24
11 direct.

12 THE WITNESS: I can't answer that.

13 BY MR. BREGMAN:

14 Q Because you don't know or because the patent
15 doesn't mention it? 01:18:34

16 A Because I don't know.

17 MR. PETROFF: It's been over an hour.

18 MR. BREGMAN: Let me just finish this line of
19 questions.

20 MR. PETROFF: Sure.

21 BY MR. BREGMAN:

22 Q If you look at Column 6.

23 A Okay.

24 Q Line 56.

25 A Okay. Column 6. 01:19:00

Page 167

1 Q It says, "In another" --

2 A Wait, wait, wait. Hold on.

3 Okay, go ahead.

4 Q Column 6, line 56, it says:

5 "In another preferred embodiment, 01:19:30

6 the thickness of Layer (a) is less

7 than 15 micrometers, for example, 14,

8 12, 10, 8, 6, 4, 2, or 1 micrometer,

9 and all whole numbers, ranges, and

10 subranges therebetween, and including 01:19:52

11 all numbers between each listed value

12 as if written out in its entirety

13 (e.g., 13.84 micrometers)."

14 Do you see that?

15 A Yes. 01:20:06

16 Q The patent doesn't give you any directions on

17 how you get from a 15 micrometer thick layer to a 10

18 micrometer thick interdiffusion layer, right?

19 A Yes.

20 MR. BREGMAN: Why don't we take a break. 01:20:27

21 THE WITNESS: Okay.

22 THE VIDEOGRAPHER: The --

23 MR. BREGMAN: Come back maybe on the half

24 hour?

25 THE WITNESS: Okay. 01:20:35

Page 168

1 THE VIDEOGRAPHER: The time is 1:20 p.m. and
2 we are off the record.

3 (Recess.)

4 THE VIDEOGRAPHER: The time is 1:41 p.m. and
5 we are back on the record. 01:41:43

6 BY MR. BREGMAN:

7 Q So, Dr. DeArdo, I'd like to return back to
8 the Cornette reference, Exhibit 1013.

9 A Yes.

10 Q I don't think I fully understand what your 01:41:57
11 position is on what heat treatment is as compared to
12 hot forming or whether they're one and the same.

13 MR. PETROFF: Objection. Asked and answered.
14 Calls for a narrative.

15 THE WITNESS: I'm sorry I haven't made it 01:42:14
16 clear.

17 BY MR. BREGMAN:

18 Q No problem. But if you could just sort of
19 walk me through that again.

20 When we're looking at Figure 21 and we read a 01:42:37
21 sentence above that a little bit that spoke about
22 heat treatment or hot forming, and I don't think I
23 completely appreciate what you are saying heat
24 treatment is and what hot forming is.

25 A Okay. 01:42:47

Page 169

1 MR. PETROFF: Objection. Asked and answered.

2 BY MR. BREGMAN:

3 Q So maybe you can describe it in terms of
4 Figure 21 so I can understand it better.

5 A Hang on. Let me find it. 01:42:56

6 Oh, here it is. Okay. Let's go back to
7 Figure 21.

8 Q Okay.

9 A Of Cornette.

10 Q Yes. 01:43:36

11 A On page 9.

12 Q Uh-huh.

13 A Okay. So let's start on the left side where
14 we see, "Precoated Usibor 1500." That's the steel
15 of interest here. That's the boron steel. It's the 01:43:57
16 derivative of 22 MM B5.

17 Q Okay.

18 A Now, it comes out of either the hot mill or
19 the cold mill, and goes through this aluminum tank
20 at 700 C, about. That's the starting point. 01:44:23

21 Now, it can either be formed into this shape
22 at room temperature at the expenditure of a lot of
23 energy and a lot of fracture, a lot of rejects,
24 because the steel is not all that ductile. Okay?

25 Then it can be heated to 900 C five minutes and 01:44:57

Page 170

1 water quenched. Then you have a coated martensitic
2 steel at room temperature of the shape you want with
3 a UTS of 1500 MPa.

4 Q Okay.

5 A That's one approach. 01:45:22

6 Q Okay.

7 A Another approach is to take either a hot
8 rolled or cold rolled steel, again put it through
9 the aluminizing line, 700 C, get a coated product to
10 start with, and these steels would be sectioned into 01:45:37
11 blanks. And this is all done by mathematics. They
12 would -- these pieces would be cut such that after
13 the stamping, they would be precisely the right
14 size. Sometimes they're called a preform. Okay?

15 Okay. So now we have these coated steel 01:46:27
16 blanks on a roll -- on a conveyor belt that is going
17 into a furnace. And it goes into the furnace and
18 while it's in the furnace, obviously it gets heated
19 up to 900 C. How fast it gets heated up is a pretty
20 important issue. But we're not going to argue that 01:46:58
21 right now.

22 So it's heated up to about 900 centigrade,
23 maybe -- like I said before, maybe a smidge even
24 above 900 to allow for the cooling during transfer.

25 So the process stops at, say, after five 01:47:18

Page 171

1 minutes at 920 C, and the blank is removed by robots
2 and transferred to the hot dies. The dies come
3 down, stamp the part, then water is turned on and
4 the specimen, the steel is quenched in the die with
5 these water-cooled dies. And they're cooled all the 01:47:48
6 way to room temperature, 400 C anyway. Probably
7 lower.

8 Now, the first one was heat treated. Cold
9 formed plus heat treated. Cold form plus reheated,
10 austenitized and quenched. Okay? Done. 01:48:16

11 The second one was hot stamped. Heated,
12 transferred, stamped, and quenched.

13 Q So you're saying those are two different
14 processes, one is called heat treatment and one is
15 called hot forming? 01:48:36

16 A Yes.

17 Q Now, the Cornette reference only describes
18 the hot forming, right?

19 A Yes.

20 Q It doesn't describe the regular heat 01:48:49
21 treatment?

22 A Yes.

23 Q It only does the hot forming?

24 A Right.

25 Q But it still uses the word "heat treatment." 01:48:58

1 That's what I'm confused about. So if it's using
2 the word "heat treatment" in this hot forming
3 process, what is the heat treatment part of the hot
4 forming?

5 MR. PETROFF: Objection. Asked and answered. 01:49:11

6 THE WITNESS: It's the heating to the die
7 temperature, heating to the forming temperature,
8 holding, stamping, cooling.

9 BY MR. BREGMAN:

10 Q I see. I see. Okay. Okay, I got it. 01:49:24

11 A It's okay. I mean --

12 Q Yeah. No, I understand now. Thank you.

13 All right. Let's switch gears a little bit
14 and -- actually, on the same -- kind of the same
15 topic, but in your paragraph 56, you say -- at the 01:49:42
16 end of the paragraph you say:

17 "There is no basis to conclude
18 that the heat treated coating of
19 Cornette Figure 22, would, when
20 stamped, provide the claimed 01:50:05
21 four-layer structure."

22 Do you see that?

23 A I don't see it, but I remember it.

24 Q Okay. My question is, how does stamping
25 change the layer structure of the coating of the 01:50:16

Page 173

1 steel substrate? Would the stamping affect or
2 change the layer structure of the steel substrate?

3 A Well, at the time of this patent, no one knew
4 that. But we could imagine what would happen.

5 For example, the phase diagrams of the 01:51:05
6 patent, say mid 2000s, 2005, 2006, showed liquation
7 in this composition. The coating could be melted.
8 Okay? And if it were melted and then hot stamped,
9 then it would be stamping a hard steel -- a steel
10 with a semisolid surface. 01:51:40

11 Q Uh-huh.

12 A And it could be smearing all over the place.
13 It could be causing God knows what. Okay? But
14 nobody really knows that.

15 Now we have a better handle on things. Okay? 01:51:58
16 But, I mean, obviously it's a very good question.
17 But to assume that the stamping doesn't do anything
18 I think is very, very naive.

19 Q I mean, is there a way that one could
20 determine whether stamping would affect the layers? 01:52:23

21 MR. PETROFF: Objection. Foundation.

22 THE WITNESS: Here -- here is the problem.
23 Remember we said that -- I don't know what, David,
24 two hours ago maybe? We said the steel companies
25 don't do the hot stamping. 01:52:46

1 BY MR. BREGMAN:

2 Q Uh-huh.

3 A These are third-party companies. And it's
4 hard for the steel company to get access to those
5 presses and stamping. Because they held it very 01:53:04
6 close to their chest, secret. Whether it's
7 justified or not is another discussion, right? But
8 it's not easy for steel companies to go in and say,
9 well, we'd like to run this really sophisticated
10 trial where we partially stamp and quench and do 01:53:24
11 this and check how the coating is changing with time
12 and so forth. All right? That would be the way to
13 do it. If you were doing a Ph.D. thesis, that might
14 be the way you would do it.

15 BY MR. BREGMAN: 01:53:42

16 Q I see.

17 A But then again, universities don't have that
18 kind of equipment either. You could probably build
19 something small to do it.

20 Q Okay. Let's look briefly at Figure 7 of the 01:53:53
21 patent.

22 A All right.

23 Q There's a brief description in Column 4, a
24 short description, brief description of Figure 7
25 that says the following: 01:54:31

Page 175

1 "Figure 7 shows conditions of
2 furnace temperature as a function of
3 the total dwell time in the furnace
4 for sheets of total thickness of from
5 0.7-1.5 and 1.5-3 millimeters that 01:54:48
6 provide particularly favorable
7 coatings for welding."

8 So with that in mind, or anything else from
9 the patent, could you tell me what Figure 7 is
10 showing? 01:55:10

11 A Sure.

12 MR. PETROFF: Objection to form.

13 THE WITNESS: Okay. The one thing that is
14 not shown on here is, again, the heating rate. The
15 heating rate has to be controlled so that we keep 01:55:40
16 the right layered structure.

17 BY MR. BREGMAN:

18 Q Okay.

19 A Now, what you see here are two trapezoids,
20 right? The thinner one is the H and the thicker one 01:55:54
21 is the darker B. And that gives -- that gives
22 direction on where we get the best weld nugget
23 geometry. So somewhere between E, F, G, H, if the
24 temperature is, say, 920 with a 7-minute dwell time,
25 it would be right around that -- in that 1.5. That 01:56:33

Page 176

1 would be good. That would have a good nugget, a
2 good property.

3 Or, see, 1.5 to 3 millimeters is the hot
4 rolling gauge. Okay? You can't hot roll much below
5 1.5 millimeters. That's why we have -- if Citroen 01:57:03
6 wants 1 millimeter material, it has to be cold
7 rolled because you can't hot role. Get it?

8 Q Uh-huh.

9 A So the trapezoid labeled H with A, B, C, D,
10 is for your thinner gauge material. But, again, 01:57:25
11 this is like the recipe for good weldability.

12 Q Uh-huh. So in order to meet this sort of
13 embodiment, you do need to stay within those
14 trapezoids is what you're saying?

15 A Yes. 01:57:43

16 MR. PETROFF: Objection. Beyond the scope of
17 direct.

18 BY MR. BREGMAN:

19 Q And what would happen -- so let's say the top
20 trapezoid -- I'm just going to say the top is 940 01:57:49
21 degrees C. So let's say right in the middle of
22 that, say 10 -- let's say the corner E is at 940
23 degrees C at five minutes.

24 A Yes.

25 Q So if I heated my product to 940 degrees heat 01:58:09

1 for five minutes, I would fall within this
2 trapezoid; is that right?

3 MR. PETROFF: Objection. Beyond the scope of
4 direct.

5 THE WITNESS: Yes. 01:58:24

6 BY MR. BREGMAN:

7 Q And that would give me the weldability or
8 whatever other properties you're looking for?

9 A Yes.

10 MR. PETROFF: Objection. Beyond the scope of 01:58:31
11 direct.

12 BY MR. BREGMAN:

13 Q And if I went to 950 for five minutes, that
14 would be outside of the -- these parameters, right?

15 A Yes. 01:58:49

16 Q What happens if I went to 940 for three
17 minutes and then 950 for one minute and then I came
18 back to 940 for another two minutes?

19 MR. PETROFF: Objection. Beyond the scope of
20 direct. Incomplete hypothetical. 01:59:04

21 THE WITNESS: It's a good question. I don't
22 know that I could even guess what that would be.
23 Because I'm not sure these things are reversible.

24 BY MR. BREGMAN:

25 Q Meaning once you go above that 940 -- I'm 01:59:22

Page 178

1 just following Dr. DeArdo's lead -- that once you go
2 outside of these parameters in these trapezoids, you
3 can't sort of come back in and still get the same
4 properties, right?

5 MR. PETROFF: Objection. 01:59:41
6 Mischaracterization.

7 BY MR. BREGMAN:

8 Q Is that a fair characterization?

9 A Yeah. Yeah, I would think so.

10 Q I may just have a couple more questions to 01:59:48
11 wrap up, but I need maybe 15 minutes to just sort of
12 go through my notes and see if there is anything
13 else.

14 A Okay.

15 MR. BREGMAN: Give me 15 minutes and I'll be 02:00:01
16 back.

17 THE VIDEOGRAPHER: The time is 2:00 p.m. and
18 we are off the record.

19 (Recess.)

20 THE VIDEOGRAPHER: The time is 2:13 p.m. and 02:13:56
21 we're back on the record.

22 BY MR. BREGMAN:

23 Q So, Dr. DeArdo, earlier we were discussing
24 sort of the process for hot stamping, and you had
25 explained to me that you normally heat the blank up 02:14:08

Page 179

1 to round about 900 degrees C, or maybe a little bit
2 higher than that, and then you take the blank and
3 you put it in a die and then you stamp it. So the
4 die can handle stamping a product at 900 degrees C?

5 MR. PETROFF: Objection. Beyond the scope of 02:14:44
6 direct.

7 THE WITNESS: Yes.

8 BY MR. BREGMAN:

9 Q But typically the temperature drops some by
10 the time it gets to the die, is my thought process, 02:14:54
11 right?

12 MR. PETROFF: Objection.

13 THE WITNESS: From the furnace onto the
14 conveyor belt or in the robot's arms to the die, it
15 is some time and it cools, of course. 02:15:07

16 BY MR. BREGMAN:

17 Q I see. So it will cool, whatever, 20 degrees
18 or something?

19 A Something like that.

20 Q Okay. Let's look at -- let's look at your 02:15:14
21 paragraph 207.

22 A Okay.

23 Q The last sentence of that paragraph. I'll
24 wait for you to get there.

25 A Okay. Okay. 02:16:07

Page 180

1 Q The last sentence says:

2 "A person of ordinary skill in
3 the art would have understood that
4 this cooling rate is the rate of
5 cooling in the stamping press, and
6 does not include the cooling of the
7 blank from the exit of the furnace
8 until the blank is placed in the
9 stamping press."

02:16:17

10 And I believe you're talking about the Somani 02:16:29
11 reference now?

12 A Yes.

13 Q Can you let me know why you believe that the
14 cooling occurs in the stamping press?

15 MR. PETROFF: Objection, form. 02:16:52

16 THE WITNESS: Dr. Somani has equipment very
17 similar to what we have in our lab, and that is we
18 have compression dies surrounded by a furnace. And
19 so there is not a separate reheat phase where the
20 sample is then transferred to the compression die. 02:17:24

21 In other words, in Somani's work or in our
22 work, you do the compression and then you start the
23 cooling immediately. So it's not you're reheating
24 one furnace, you transfer it to the die, you deform
25 in the die and quench in the die. That's not what 02:17:49

Page 181

1 Somani does, and that's not what we do.

2 Does that make it any clearer?

3 BY MR. BREGMAN:

4 Q So where is the quenching occurring? Is it
5 occurring in the die or in the bath or what? 02:18:07

6 MR. PETROFF: Objection. Beyond the scope of
7 direct.

8 THE WITNESS: These would be -- these would
9 be -- these are laboratory simulations. These are
10 fairly high pressure gas sprays impinged on the 02:18:22
11 steel to cool them. A good example is helium. It
12 has really excellent thermal conductivity. It can
13 really cool hot steel quickly.

14 BY MR. BREGMAN:

15 Q So let me back up a little bit. 02:18:42

16 It sounds like you know Mr. Somani?

17 A I'm sorry?

18 Q Do you know Mr. Somani?

19 MR. PETROFF: Objection. Beyond the scope of
20 direct. 02:18:51

21 THE WITNESS: I do.

22 BY MR. BREGMAN:

23 Q And you know him because he is -- you haven't
24 taught at his university in Finland? It's a
25 different -- 02:19:05

Page 182

1 A No, I did.

2 Q You did teach at the University of Oulu,
3 O-U-L-U?

4 A Yes.

5 Q So do you know all of these authors on this 02:19:16
6 paper, Exhibit 1005?

7 A No. I think -- I think he is the only one I
8 know.

9 Q Okay. And the reason for your belief that
10 they are cooling in the die is based on your 02:19:38
11 understanding of Mr. Somani's lab setup?

12 A Yes.

13 MR. PETROFF: Objection. Beyond the scope of
14 direct.

15 BY MR. BREGMAN: 02:19:50

16 Q Is there anything in the reference itself
17 that would tell someone whether or not there is
18 cooling in the die?

19 MR. PETROFF: Beyond the scope of direct.

20 THE WITNESS: No. There wouldn't be cooling 02:20:07
21 in the die. They don't have water-cooled dies.
22 They have a Gleeble, G-L-E-E-B-L-E.

23 BY MR. BREGMAN:

24 Q What is a Gleeble?

25 A Gleeble? It's a hot deformation simulator. 02:20:23

Page 183

1 Q Is that done on a computer, or is that an
2 actual simulation? Is that what you're --

3 A Yeah, yeah.

4 MR. PETROFF: Objection to form.

5 THE WITNESS: It's a hot deformation machine. 02:20:38
6 Computer-controlled hot deformation machine.

7 BY MR. BREGMAN:

8 Q And that's called a stamping press?

9 A No. But it can do hot compression followed
10 by cooling if you want to simulate some part of hot 02:20:52
11 stamping.

12 Q And that Gleeble, how do you know that he is
13 doing this experiment in the Gleeble?

14 MR. PETROFF: Objection. Beyond the scope of
15 direct. Calls for speculation. 02:21:09

16 THE WITNESS: I think this is the only hot
17 deformation machine he has access to. At least at
18 that time.

19 BY MR. BREGMAN:

20 Q And you know that just from visiting his lab? 02:21:20

21 A Yes. And also looking at the strains he was
22 imparting. Those strains are enormous.

23 Q And you would not get those sort of strains
24 except if you were using a Gleeble?

25 A A three-dimensional forging as opposed to a 02:21:42

1 two-dimensional bending of the sheet.

2 Q What is -- is stamping two dimensional or
3 three dimensional?

4 MR. PETROFF: Objection, form.

5 THE WITNESS: Two dimensional. 02:22:05

6 BY MR. BREGMAN:

7 Q Thank you.

8 Would the cooling rates in Somani work to
9 create a martensitic structure in a base steel for a
10 process in which the base steel is transferred from 02:22:41
11 a furnace to a die?

12 MR. PETROFF: Objection, foundation.
13 Incomplete hypothetical.

14 THE WITNESS: I'm -- I'm not trying to be
15 difficult here. I'm just saying that the heating 02:22:56
16 and the deformation and the cooling all take place
17 in the same place.

18 Do you want me to expand on that a little
19 bit?

20 BY MR. BREGMAN: 02:23:29

21 Q Yeah, please do. I'm just not sure what --
22 how you're getting there.

23 MR. PETROFF: Objection. Beyond the scope of
24 direct.

25 THE WITNESS: Okay. Somani would start with 02:23:36

1 a solid cylinder of a certain size. And this -- and
2 then he would take this cold cylinder and put it
3 between the two compression platens in his Gleeble.
4 And then he would close the chamber, push a green
5 button, and the dies would come together and at the 02:24:08
6 same time heat the sample with a certain heating
7 rate. And then when he was at 800, 900 C, whatever
8 he used, then it would go into the deformation
9 program and it would squeeze the sample, compression
10 along the axial length. Okay? 02:24:35

11 Then when that's done, he would change the
12 computer to blow whatever coolant they're using on
13 the compressed sample. And you would get a range of
14 cooling rates. You saw it in the paper. A range of
15 cooling rates from, you know, 10 C a second to 200 C 02:25:06
16 per second. It's a simulation of the steps that are
17 involved in hot stamping.

18 BY MR. BREGMAN:

19 Q I see. So it's using this lab equipment to
20 simulate what hot -- what would occur in hot 02:25:30
21 stamping?

22 A As I said before, it's really difficult for
23 most of us to do anything like real hot stamping.
24 We can do approximations.

25 Q I understand now. Thank you. 02:25:47

1 A For example, that -- that program we did with
2 POSCO that you asked me about four hours ago, right,
3 those samples were never stamped. They were just
4 heat treated. And our job was to evaluate the
5 ductility at room temperature in a heated and 02:26:21
6 quenched flat sheet.

7 Q But if you're trying to simulate an actual
8 stamping process, then you want to try to simulate
9 as close to the real thing as possible, right?

10 MR. PETROFF: Objection. Beyond the scope of 02:26:45
11 direct.

12 BY MR. BREGMAN:

13 Q Is that right?

14 A Correct.

15 Q Let's turn back to the patent, if you don't 02:26:48
16 mind.

17 A Okay.

18 Q And look at Claim No. 10. Let me know when
19 you're there.

20 A I am now. Go ahead. 02:27:40

21 Oh, Claim No. 10. Just give me a second.

22 Q It says:

23 "The coated steel stamped product

24 according to Claim 1, wherein the

25 product includes a full martensitic 02:27:46

Page 187

1 structure."

2 Do you see that?

3 A Let's go back. I'm on the claims. Which one
4 are you looking at?

5 Q Claim 10. 02:27:56

6 A 10. Okay, got you.

7 Q Let's start with what is a martensitic
8 structure?

9 MR. PETROFF: Objection. Beyond the scope of
10 direct, Claim 10. 02:28:15

11 THE WITNESS: Okay. It's a -- it's a
12 metallurgical structure that -- martensite is a
13 metallurgical microstructure that is probably the
14 hardest structure we can make in steel.

15 BY MR. BREGMAN: 02:28:57

16 Q And that's because of its particular
17 crystalized structure?

18 A Yes. And also because it's a super saturated
19 solid solution of carbon in deformed -- in highly
20 deformed ferrite. You can put ferrite in quotes. 02:29:23

21 Q The claim says "wherein the product includes
22 a full martensitic structure." So what does the
23 word "includes" there mean?

24 MR. PETROFF: Objection. Beyond the scope of
25 direct. 02:29:49

Page 188

1 THE WITNESS: Well, if you don't -- if the
2 steel is not fully austenitized, say not enough time
3 or not high enough temperature above the A3 line,
4 then you're not going to get 100 percent martensite.

5 BY MR. BREGMAN: 02:30:11

6 Q It doesn't say the product is fully
7 martensitic.

8 A Okay. So if it is, then it would --

9 MR. PETROFF: Objection. Beyond the scope of
10 direct. 02:30:18

11 THE WITNESS: If it was fully martensitic,
12 then it was fully austenitized and then quenched
13 fast enough to avoid all the high temperature
14 transformation product.

15 BY MR. BREGMAN: 02:30:31

16 Q But the claim saying it includes full
17 martensitic structure. It means that --

18 A Yes.

19 Q -- it includes. It's not exclusively
20 martensitic, right? 02:30:41

21 MR. PETROFF: Objection. Beyond the scope of
22 direct.

23 BY MR. BREGMAN:

24 Q What is your understanding of what "includes"
25 means? 02:30:53

Page 189

1 MR. PETROFF: Objection. Beyond the scope of
2 direct.

3 THE WITNESS: I -- I don't think I can answer
4 that.

5 BY MR. BREGMAN: 02:31:12

6 Q Because of why?

7 A Because if it's a fully martensitic
8 structure, it means it's 100 percent martensite.
9 But if they're saying it includes 100 percent
10 martensite, then what else does it include, if 02:31:27
11 anything?

12 Q That's my question. What else? Is it
13 possible for it to include something other than
14 martensite?

15 MR. PETROFF: Objection. Beyond the scope of 02:31:35
16 direct.

17 THE WITNESS: If you look at Somani, he had
18 final structures that included quite a bit of
19 ferrite plus martensite.

20 BY MR. BREGMAN: 02:31:48

21 Q So you could have some fully martensitic
22 structure as well as having some ferrites in the
23 same product?

24 MR. PETROFF: Objection. Beyond the scope of
25 direct. 02:32:05

Page 190

1 THE WITNESS: Yes, but it wouldn't have the
2 1500 MPa strength.

3 MR. BREGMAN: Okay. Thank you, Dr. DeArdo.
4 That's all I've got.

5 And I understand there's some -- some 02:32:31
6 redirect?

7 MR. PETROFF: Yeah, could you just give us
8 five minutes?

9 MR. BREGMAN: Sure.

10 MR. PETROFF: Thanks. 02:32:38

11 THE VIDEOGRAPHER: The time is 2:32 p.m. and
12 we are off the record.

13 (Recess.)

14 THE VIDEOGRAPHER: The time is 2:34 p.m. and
15 we are back on the record. 02:34:21

16 MR. PETROFF: We have no redirect.

17 MR. BREGMAN: Great. Well, thank you very
18 much, Dr. DeArdo. Very nice speaking to you. And
19 stay safe.

20 THE WITNESS: Yes, thank you. It was 02:34:33
21 enjoyable, all things considered.

22 MR. BREGMAN: Thanks, David. Thanks, Cary.
23 Thanks Kathy and Nicholas.

24 And if we can get -- Kathy, what's the
25 turnaround on the transcript?

1 THE REPORTER: Shall we go off the record for
2 a second?

3 THE VIDEOGRAPHER: We are off the record at
4 2:34 p.m. and this concludes today's testimony given
5 by Dr. Anthony DeArdo. The total number of media
6 units used was one and will be retained by Veritext.

7 * * *

8
9
10
11
12
13
14
15
16
17
18
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, ANTHONY DEARDO, Ph.D. , do hereby declare under penalty of perjury that I have read the foregoing transcript; that I have made any corrections as appear noted, in ink, initialed by me, or attached hereto; that my testimony as contained herein, as corrected, is true and correct.

EXECUTED this ____ day of _____,
20____, at _____, _____.
(City) (State)

ANTHONY DEARDO, Ph.D.

Anthony J. DeArdo
Acknowledgment Of Deponent

I, Anthony J. DeArdo, do hereby certify that I have read the foregoing transcript of my testimony taken on June 18, 2020, and further certify that it is a true and accurate record of my testimony (with the exception of the corrections listed below):

Page	Line	Change	Reason
15	11	"in" to "and"	
135	6	"22MMB5" to "22MnB5"	Typo
136	1	"800" to "880"	Typo
159	11	Replace "Strain" with "Stress-Strain"	Typo
170	16	"22MMB5" to "22MnB5"	
Page	Line	Correction	Reason

Page	Line	Correction	Reason

Subject to the above changes, I certify that the transcript is true and correct.

Anthony J. DeRubeis
Signature

6/28/2020
Date

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

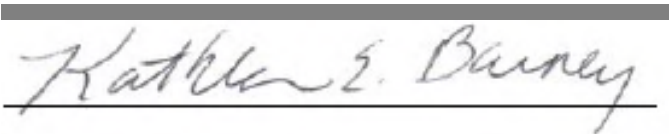
I, the undersigned, a Certified Shorthand Reporter of the State of California, do hereby certify:

That the foregoing proceedings were taken before me at the time and place herein set forth; that any witnesses in the foregoing proceedings, prior to testifying, were placed under oath; that a record of the proceedings was made by me using machine shorthand which was thereafter transcribed under my direction; further, that the foregoing is an accurate transcription thereof.

I further certify that I am neither financially interested in the action nor a relative or employee of any attorney of any of the parties.

IN WITNESS WHEREOF, I have this date subscribed my name.

Dated: This 23rd day of June, 2020.

A handwritten signature in cursive script, reading "Kathleen E. Barney", is written over a solid horizontal line.

KATHLEEN E. BARNEY

CSR No. 5698

&	10018 3:19 54:19	150k 10:13	62:20 194:20
& 3:5,15 6:2 54:5 54:15	1004 131:20 132:4	15kv 94:23,24	204 155:18
0	1005 156:24 183:6	162 160:2,7	207 180:21
0.21 158:25	1013 4:13 83:1,9 131:20 132:4,5,21 133:6 135:8 169:8	18 1:14 2:15 5:1,5 33:10,12 52:14 53:15	21 81:10 135:11,15 143:3 169:20 170:4,7
0.7-1.5 176:5	1013-0009 135:12	19 34:14	212 3:20 54:20
006 93:19	1014 83:1 131:20	1975 18:12,15	22 21:15 76:5 81:1 81:10 122:15,19 135:6 139:20 144:9 147:11 150:5 151:18 153:11 155:6 170:16 173:19
1	1050 4:12 56:5,6 56:10	1:20 169:1	22.34 81:15
1 5:6 63:4,24 65:11 66:10 67:2 67:4,8 68:15 91:16 92:4,12 94:11 95:6 96:13 96:20 97:9 100:25 101:1,3 110:1,5,7 110:8,12,13,14 122:15,19 125:5 126:15 160:10 161:7 166:11,20 167:7 168:8 177:6 187:24	10:06 80:6	1:41 169:4	23 81:10
	10:10 80:2	2	23rd 62:20 194:20
	10:21 80:9	2 64:9,14 65:4 84:4,15,24 85:8,20 85:22 86:24 87:3 92:3,12 95:6 96:13 112:6 121:18 122:4,15 122:19 168:8	24 81:10
	10:55 100:17	2-01-1999 145:1	25 35:6 81:1,10 165:21
	10:58 100:20	20 44:16 45:7,14 45:15 61:9 81:8 82:8 124:18,25 136:1 145:8 156:17 180:17 193:9	26 81:10 84:3
	11 15:12 160:8 162:21 166:12,21 167:9	200 157:23 186:15	27 25:25 38:11 81:10
	11:35 124:2,6	2000s 174:6	28 81:10
	12 73:18 75:1 77:13,19 78:1,3,24 79:14 110:21 166:15 168:8	2001 8:13	29 81:10 117:12
	12:12 124:9	2005 174:6	2:00 179:17
	13 17:14 21:6 84:3 84:3	2006 14:1,2 25:11 30:5 47:7,13 105:18 106:17 174:6	2:13 179:20
	13.84 168:13	2007 132:4	2:32 191:11
	136 104:5 109:25 110:16,18	2010 4:14 8:18 9:1 9:6	2:34 2:14 53:14 191:14 192:4
	14 132:4 168:7	2013 40:17	3
	1400 3:9 54:9	2015 40:17	3 65:7 67:7 72:17 84:22 177:3
	15 10:4 93:16 124:18,25 167:6 168:7,17 179:11 179:15	2019-01275 8:3	30 26:1 81:11
	150 93:14,15,16 94:7 162:3	2020 1:14 2:15 5:1 5:5 52:14 53:15	31 81:11 97:8 103:14 114:15,16 126:21
	1500 43:5 48:19 135:23 142:12 143:9 170:14 171:3 191:2		32 42:6,20 81:11
			33 70:12,14 81:8 82:11

34 71:2,6,7,8 364 157:8 365 157:9,10 3c 145:16,21,22,23	5979 62:23 194:23	86 98:4	absorbed 133:19
	6	880 136:13,23 137:4,10	accelerating 94:23 95:1
4	6 4:6 30:11 64:10 64:15 72:13,17 97:8 98:1 100:24 100:25 102:24 167:22,25 168:4,8	8:00 2:14 5:2,5 53:14	acceptable 26:12
	600 117:20	8:57 40:3	accepted 25:24
4 72:17 73:18 75:1 77:13,19 78:1,2,24 79:14 98:4 166:15 168:8 175:23 40 13:24 76:5 400 26:21 27:5,6 44:22 158:3 172:6 41 73:15,17 4140260 1:22 52:22 42 73:20 44 82:13 47 85:16 49 85:18	61 111:18 112:8 63 65:7 84:22 650 3:11 54:11 67 84:23 126:19,23 68 114:14,16 683 8:8 21:13 26:2 26:5 42:7,9 60:10 63:3,23 66:17 72:3 73:7,11 83:24 84:2,5,16 85:7,19 104:12 110:1	8th 3:18 54:18	accepting 153:17 access 175:4 184:17
	7	9	accessories 16:14
5	7 76:2 157:16 175:20,24 176:1,9 176:24 70 131:17 132:1 700 170:20 171:9 70s 14:5,8 38:4,6 71 134:10 736-1940 3:20 54:20 77 4:13	9 4:14 83:9 135:11 159:3,10,17 170:11 9,708,683 1:7 2:7 8:7 52:7 53:7 900 47:1 48:5,6,21 83:8,16 140:17 143:17 170:25 171:19,22,24 180:1,4 186:7 920 172:1 176:24 940 177:20,22,25 178:16,18,25 94304 3:10 54:10 950 136:1,13,24 137:10 178:13,17 9:08 40:6	account 38:17 accurate 62:13 194:13 achieve 83:12 action 5:16 62:15 194:15 activities 165:1 activity 128:12 actual 29:21 83:10 83:16,19 184:2 187:7
	8	a	add 127:23 added 56:11 address 37:9 50:12,14 adds 128:8 adjunct 31:4 32:22 adjusting 166:17 administered 6:10 advanced 17:23 18:2 affect 13:17 163:8 163:12 164:10,24 166:2 174:1,20 affiliated 31:21 affiliations 5:19 aggressive 29:17 ago 10:2,4 15:24 109:25 121:25 174:24 187:2
5 10:24 14:11 80:25 157:6,7 5-10 137:10 50 44:25 45:1,5 159:15 50k 10:12 32:17 32:18 52 4:12 72:13,17 52-62 1:25 52:25 53 72:13 56 55:6 65:8 67:7 167:24 168:4 173:15 5698 1:21 2:16 52:21 53:16 62:25 194:25 57 4:11 110:21 589 3:18 54:18 59 63:4,25	8 17:16 158:17 159:3,4,6,16 168:8 800 48:19 136:1 159:20 186:7 81 30:23 83 30:23 843-7278 3:11 54:11	a.m. 2:14 5:2,5 40:3,6 53:14 80:6 80:9 100:17,20 124:6 a3 12:2,3 21:17 23:4 43:25 44:7 137:5 160:1 189:3 ability 79:2 able 87:2 128:18 150:25 151:9,20 152:10 153:6 154:5 absence 157:19	

[agree - assumption]

agree 64:25 65:3 102:17 147:1 150:15,16 ahead 24:10,20 27:3 35:25 111:9 124:24 127:19 168:3 187:20 air 30:2 88:14 al 86:3 89:1 90:5,6 alex 5:24 49:24 50:5,17 56:17 57:2 59:1 60:16 60:17 alexander 3:7 54:7 alive 141:5 alleged 83:12 alleviate 29:16 allow 13:7 171:24 alloy 15:15 16:18 16:25 72:9,21,23 73:3 136:2,12 alloyed 73:22 117:16 119:6 alloying 17:10 19:14 63:7 83:6 135:14 139:7 140:7 alloys 15:18 21:16 altered 129:14 altering 14:18 165:3 alternate 154:19 alternating 154:20 alto 3:10 54:10 aluminizing 18:7 171:9 aluminum 21:16 21:16 22:17 41:1 71:19,23,24 72:1,4 72:11,14,18,21,23 73:3 85:23 86:12	86:18 87:25 88:2 88:6,17 89:11,18 94:16 98:4 108:17 108:19 117:15 119:5 170:19 alusi 145:15,19,20 145:23,23 americans 142:25 amount 19:15 27:9 155:23 156:20 159:12,13 163:18 analysis 122:25 129:24 analyzed 88:23 answer 28:3 41:13 68:18 70:7,9,11 74:7 76:11 90:13 92:8 94:4 95:10 101:21 102:8,9 106:12 119:9 128:7 129:18 131:1 132:14 137:2 146:21 151:6 162:7 167:12 190:3 answered 27:1 33:3 37:12 68:12 74:21 75:11 78:13 92:14 102:25 107:3 118:14,20 127:17 148:15 163:10 169:13 170:1 173:5 answering 7:25 anthony 1:13 2:12 4:3 5:7 6:4,9 52:13 53:12 55:3 61:2,13 192:5 193:2,13	anticipation 127:3 anybody 80:17 anyway 24:13 87:11 172:6 apparently 70:3 appeal 1:2 2:2 52:2 53:2 appear 61:5 115:24 162:14 193:5 appearance 5:22 appearances 3:1 5:19 54:1 appears 144:20 applicant's 38:22 applications 41:11 applied 26:2 73:9 114:20 138:11 apply 59:6 130:19 142:4 applying 11:25 153:24 appreciate 49:13 103:12 155:2 169:23 approach 87:6 121:12 152:22 153:13 171:5,7 approximations 186:24 arcelormittal 1:8 2:8 5:9 6:3 9:11 9:15,19,24 10:3,9 10:19 40:14 41:16 41:23 49:10 52:8 53:8 133:19,23 142:10,11 146:17 area 34:1,4 40:25 70:25 113:3 areas 86:19	argue 171:20 arm 146:6 arms 180:14 arrows 88:21 art 36:18 37:2,6 38:19 39:1,5 47:13 48:25 66:4 74:11,19 75:8 77:20,24,25 78:9 78:20 83:7 84:4 92:16 104:24 105:17 106:2,5,7 106:14,16,24 107:5 109:6 116:5 136:20 153:4 181:3 art's 156:18 article 142:10 artifact 67:25 asked 27:1 37:11 67:23 68:12 74:21 75:10 78:13 92:14 102:25 106:25 107:2 108:10 118:14,20 127:17 148:15 151:18 163:10 169:13 170:1 173:5 187:2 asking 106:23 110:12 147:21,23 148:5,7,8 149:5,13 149:16 assisting 10:21 association 33:5 assume 7:16 23:11 133:20 134:3,6 145:3 149:12 174:17 assuming 153:2 assumption 92:19 99:18,21,22
--	---	---	--

[atomic - blow]

atomic 165:1 atoms 19:7 121:1 attached 61:5 193:5 attending 5:18 39:10 attention 135:10 attorney 5:22 62:16 194:16 audio 23:23 austenite 11:5,7 11:17,24 12:1,20 12:22,24 13:4,6,17 13:18,20 17:3 22:22 23:3 24:4 27:7 137:6 138:11 139:13 144:4 157:25 158:16 austenitization 140:14,15,16 austenitized 172:10 189:2,12 austenitizing 43:9 43:19 63:8 64:8 65:22 129:16 author's 132:17 authors 132:22 133:9,11 183:5 automatically 102:4 automobile 141:4 automobiles 17:24 18:3 37:25 automotive 15:10 37:16 available 97:1 average 114:11 121:4 avoid 189:13 aware 77:24	awful 147:7 axial 186:10 b b 11:11 21:18 94:16 136:9 142:12 176:21 177:9 183:22 b5 21:15 135:6 170:16 back 11:21 14:5,7 30:11 33:1,10,23 40:7 47:16 49:14 49:23 58:25 60:19 66:2,6 79:19 80:2 80:10 82:13 91:5 94:11 96:14 100:21 121:11,15 124:10,16 126:18 135:7 148:2 160:2 168:23 169:5,7 170:6 178:18 179:3,16,21 182:15 187:15 188:3 191:15 background 86:10 bainite 11:10 17:5 baked 96:5 bakelite 96:6 bampri 56:4 band 88:18 89:3 89:13 90:3,4,5,6,6 90:22,23,23,25 152:18 153:3,6 bands 87:16,20 89:1,11,25 90:17 90:20 91:4,7 147:2,2,16 148:13 148:19 149:3,8,9 149:14,16 150:6 150:11,17 151:13 151:22,25 152:2,6	banner 93:7 94:22 barney 1:20 2:15 5:15 52:20 53:15 62:24 194:24 base 39:22 72:24 73:4 115:5,8,22 116:15,25 117:14 119:4 135:4 147:17 185:9,10 based 19:8 34:25 38:15 39:17,23 151:1,21 183:10 basic 42:8 basically 106:2 basis 173:17 bath 27:23 28:18 28:22,22,23 29:9 30:6 142:8 182:5 bcc 13:1 beam 95:1 121:3,7 121:8,25 bears 34:16 beating 12:18 beginning 2:13 5:22 53:13 125:1 behalf 2:13 53:13 belief 26:5 77:11 127:7,14 128:8 153:25 183:9 believe 8:10 49:9 74:10,18,25 75:7 103:18 109:10 113:25 152:8 153:25 181:10,13 believed 58:9 belt 27:11 44:18 171:16 180:14 bending 185:1 best 176:22 better 148:9 170:4 174:15	beyond 24:6 29:11 47:22 57:6,19 58:4,12,22 59:13 60:2 117:5 118:3 118:13 125:14,20 126:3,12 127:9 128:17 130:25 153:8 154:8 162:5 162:17 166:4 167:10 177:16 178:3,10,19 180:5 182:6,19 183:13 183:19 184:14 185:23 187:10 188:9,24 189:9,21 190:1,15,24 big 13:19 33:9 41:17 73:10 93:3 128:19 binder 8:22 9:3,3 63:15 binds 70:22 bit 56:7 79:20 90:13 94:1 123:7 131:15 157:15 169:21 173:13 180:1 182:15 185:19 190:18 black 88:2,5,12,18 90:6 93:7 blades 81:25 blank 26:20 44:15 44:15 48:5 64:6,7 81:7,20 155:24 156:2,9,20 172:1 179:25 180:2 181:7,8 blanks 63:6,10 64:1 171:11,16 blow 186:12
---	--	---	---

[board - calls]

board 1:2 2:2 52:2 53:2 bockius 3:5 54:5 body 13:2 18:24 19:13,16 127:23 128:3 136:10 142:7,7 bolded 157:16 bordering 108:3 boron 41:4 47:18 135:6 170:15 bottom 35:8 86:15 93:4,8 94:23 98:5 98:11 101:15,24 141:7,12 144:12 144:20 145:6,18 145:21 146:7 149:8,17,17 150:6 150:17 151:11 157:6 bound 1:25 boundaries 107:13 boundary 109:13 bread 115:12 break 7:23,24 8:1 40:1,9 80:2,5,12 80:15,21 90:13 100:23 123:20 124:14 168:20 breath 64:23 bregman 3:6 4:6 5:23,23 6:14 18:20 22:6,24 23:14,24 24:7,9,19 25:9,17 26:4 27:2 27:21 28:6,15,24 29:20 30:10 33:20 34:10 36:11 37:4 37:14,20 38:5 39:7,24 40:8 43:17 45:13,23	46:2,10,21 47:10 47:19 48:1,22 49:5,22 50:5,11,17 50:22 51:1 54:6 55:6 56:5,8,16,19 57:1,3,8,21 58:7 58:17,25 59:2,9,19 60:9,16,20,22 63:2 65:1 66:1,12 67:1 67:6,17 68:7,13,22 69:10,19 70:2,8 72:10 73:1 74:4 74:17,24 75:6,12 75:24 76:12,21 77:2,10,18,23 78:7 78:18 79:9,18 80:1,4,11,18 82:5 85:12 88:11 89:6 89:21 90:11 91:2 92:10,15 93:1 94:6 95:11 96:11 96:22 97:23 98:17 99:7,13,20 100:12 100:22 102:2,11 103:5 104:1,6 105:4 106:1,10,22 107:7 108:18 109:3,9 111:8,17 112:3,18 113:1,18 113:24 115:20 116:19 117:10 118:8,16,24 119:16 120:8 121:23 122:11 123:20 124:2,5,11 125:17,23 126:8 126:17 127:13,18 128:6,21 129:5,11 129:22 130:8,16 131:3,9 132:13 134:2,8 136:19	137:7 138:3 139:19 142:17 143:23 144:19 146:20 147:9,20 148:22 149:11,23 150:3,14,23 151:5 152:1 153:1,10 154:12 155:1 156:16 158:18 161:15,21 162:8 162:20 163:11 164:1,15 165:12 166:8 167:1,13,18 167:21 168:20,23 169:6,17 170:2 173:9 175:1,15 176:17 177:18 178:6,12,24 179:7 179:15,22 180:8 180:16 182:3,14 182:22 183:15,23 184:7,19 185:6,20 186:18 187:12 188:15 189:5,15 189:23 190:5,20 191:3,9,17,22 brief 175:23,24 briefly 175:20 bring 60:19 broad 18:5 build 175:18 built 22:11 bullet 59:20 burden 34:16 butter 115:11,11 115:13,16 button 89:23 186:5	c c 16:10 26:1,21 27:5,6 44:22 47:1 48:5,6,21 82:20 83:8,16 91:23 94:16 132:25 136:1,13,24 137:11 140:17 141:18,18 143:17 157:23 158:3 159:15,20 166:15 170:20,25 171:9 171:19 172:1,6 177:9,21,23 180:1 180:4 186:7,15,15 cake 153:20,21,21 154:16,17,18,19 154:21,22,25 155:15 california 3:10 54:10 62:4 194:4 call 47:14 48:10,13 48:25 49:6 135:21 called 12:5,15,17 18:24 20:8 31:15 31:17 59:12 69:23 70:14 96:6,6 125:13 136:9 171:14 172:14,15 184:8 calling 88:6 132:16 149:15 calls 18:17 24:16 28:2 38:1 45:19 48:15 66:20 68:5 79:13 81:21 92:6 92:21 94:3 95:8 105:21 108:13 109:7 112:23 128:16 129:8 130:24 133:25
---	---	--	--

[calls - color]

134:7 136:15 138:1 142:14 146:18 158:13 169:14 184:15 caption 66:10 143:3 car 136:10 carbon 12:6 16:6 188:19 care 140:25 cars 18:15,24 cartoon 140:9 cary 3:17 6:1 49:9 49:10,19 54:17 191:22 case 1:7 2:7 11:20 12:15,17 19:7 27:22 28:21 31:22 52:7 53:7 67:20 157:24 cases 6:25 7:2,3 cataphoretic 141:18,21 142:5 causing 174:13 cavities 28:12 celsius 75:1 77:14 77:20 79:14 center 91:7,9,11 91:14 centered 13:2 19:13,16 centigrade 73:18 78:2,3,25 137:4 171:22 centimeter 163:16 certain 19:15 27:10 95:22 96:17 114:12 147:6 186:1,6 certainly 16:18	certainty 148:4 certified 2:15 53:15 62:3 194:3 certify 62:5,14 194:5,14 cetera 38:9 39:10 41:25 83:3 challenged 41:17 chamber 186:4 change 128:14 158:19,23 159:7 163:8 166:1,2 167:8 173:25 174:2 186:11 changed 25:24 26:3,5,10 changes 37:9 changing 11:25 164:17 175:11 characteristics 13:20 22:2 71:9 130:4,10 134:18 138:23 139:15,22 characterization 179:8 charge 138:10 check 175:11 checking 124:12 chemical 98:20 99:15 123:5 154:5 chest 175:6 chocolate 153:20 154:16,17,18,19 choose 36:17 37:8 chromatography 123:9 circulates 28:13 circulating 28:23 44:21 citroen 177:5	city 61:9 193:9 claim 34:11,12 35:24 39:23 41:24 76:10,14,16 77:3 98:12,25 99:4 120:3 125:4,4,12 125:19,24 126:1,7 126:10,15 127:11 128:3,10,15 130:3 160:8,10,20 161:10,24 162:16 162:23 163:20 166:11,12,20,21 167:7,9 187:18,21 187:24 188:5,10 188:21 189:16 claimed 38:20 39:2 79:3 97:17 173:20 claims 26:14 33:21 33:24 34:3,5,8,22 74:6,9,11,20 75:9 75:19,20,22 76:1,8 76:22 77:12 79:21 84:16 97:19 100:6 101:13,19 102:19 104:12 110:1,12 110:13 113:20 114:1 125:1 127:2 127:8,15,23 128:9 128:23 129:1,7 130:23 188:3 clear 144:22 169:16 clearer 182:2 clearly 7:21 close 6:17 127:1 134:23 175:6 186:4 187:9 coast 123:22	coated 21:8,12,16 21:21,22,25 22:11 22:12,14,15,20 24:1,3 25:12 30:4 41:1,4 43:6,7 47:6 47:18 64:7 65:12 67:9 69:12,21 116:9 125:8 126:10 127:1,21 128:12 155:24 160:9,20,25 161:17 162:1 163:2 171:1,9,15 187:23 coating 22:7 63:8 83:13 84:24 94:12 94:14 116:11 117:14 119:4 120:7 128:19,23 129:1,7,13 130:1 130:22 162:12 163:13 165:2,20 173:18,25 174:7 175:11 coatings 22:8 176:7 cold 43:7,8,18 44:14 46:25 48:5 48:18,20 69:12,21 135:24 170:19 171:8 172:8,9 177:6 186:2 collaboration 32:9 colleague 6:1 60:19 colleagues 5:24 color 88:5 89:24 96:23 121:15 149:7 152:12 155:12
---	---	--	---

[coloration - cooling]

coloration 87:8,9 colored 87:16,20 90:3,4,5,17,20,22 90:23,23,25 91:3 147:1,16 148:19 149:3,9,16 150:6 150:11,16 151:25 152:2,6 colors 123:2 147:22 149:25 151:1,12 155:8 column 63:4,24 64:9,9,14 65:4,7 67:7 72:13,17 76:2 80:25 84:3 84:22 95:2 97:8 98:1 100:24,25 102:24 110:21 117:11 124:18,25 141:6,10,11,11,12 141:15,16,16 157:11 167:22,25 168:4 175:23 combined 49:1,1 come 27:23 49:14 79:22 80:2 91:12 168:23 172:2 179:3 186:5 comes 81:24 121:15 164:21 170:18 comfortable 9:4 comment 92:24 common 18:23 22:2 23:20 24:2 26:23 companies 9:23 41:18,19 42:5 133:19 174:24 175:3,8	company 65:6 105:2 133:17,22 134:4 175:4 compare 91:16 121:5 compared 24:24 29:22 169:11 comparing 98:22 98:22 complete 130:12 completely 91:19 169:23 complicated 151:15 composed 113:6 113:13 composition 19:4 19:5 87:13,15,19 97:15 98:4,20 101:13,23 102:23 103:4,7 114:3,7,7 114:10,10,11,12 114:13,13 119:21 119:23,24 120:2 120:14 121:5,6,10 121:17 122:2,8,12 122:18,20,22 123:5,13,14,17 154:5 174:7 compositions 19:21,23 97:5 98:23 99:16 103:9 104:16 110:2,9,15 110:25 111:12 112:11 114:24 120:16,20,22 121:4,19 122:14 compound 107:24 107:25 109:16,17 120:6	compounds 107:21 109:20 121:2 compressed 186:13 compression 181:18,20,22 184:9 186:3,9 comprises 125:9 128:14 comprising 117:17 119:7 computer 184:1,6 186:12 concerned 66:18 conclude 173:17 concludes 192:4 condition 139:5 conditions 83:6,10 83:11,17,19 176:1 conductivity 182:12 conferences 39:10 confidential 1:11 1:25 49:9,12 50:2 51:6 52:11 60:21 60:24 confused 173:1 considerable 117:19 considered 21:3 46:24 191:21 consistence 157:19 constant 157:23 construction 76:11 103:21 120:3 127:12 152:15 153:2 154:1,2,3 constructions 76:14,17,23 77:4	contain 132:10 contained 61:6 193:6 contains 109:17 context 16:5 65:19 66:5 continued 63:1 continues 17:17 continuous 18:7,7 157:12 contrary 157:24 control 17:2 25:5 162:25 controlled 11:7,18 11:18 12:23 13:4 13:11,16 14:7,21 26:7,10 78:16,19 78:20,21,22 176:15 184:6 controlling 73:21 conventional 84:6 84:10 conventionally 60:7 convert 48:19 converted 136:6 conveyor 27:11 44:18 171:16 180:14 cool 27:24,24 28:13,17 29:23 45:11 180:17 182:11,13 coolant 186:12 cooled 13:6 14:23 20:21,23 23:6,15 27:18,19 130:9 142:3 172:5,5 183:21 cooling 11:7,18,18 11:19 12:11,19,23
--	--	---	---

[cooling - deeper]

13:5,10,11,12,14 13:17 14:7,21 16:15,22 21:1 24:12 25:18,21,24 26:6,8,18,19,23,25 27:4,19 28:7,13 29:2,5,24 30:1,2,2 48:12,25 58:3 64:12,17 68:23 69:3,9,22 131:12 131:13 136:11 137:16 140:18 143:19,25 157:22 157:24 158:1,16 159:14 171:24 173:8 181:4,5,6,14 181:23 183:10,18 183:20 184:10 185:8,16 186:14 186:15 cools 12:25 180:15 corner 56:11 157:7 177:22 cornette 82:17,20 82:21 83:5,23 122:20 131:19,24 132:3,16,17,17,24 133:7,20 134:17 134:19 135:7 150:5 151:18 169:8 170:9 172:17 173:19 corporation 15:7 15:8 correct 8:11 20:13 22:19 23:9,13 30:2 42:12 61:7 69:5 77:14 83:24 90:21 91:17 103:23 113:12 116:20,21 132:15	160:21 161:22 165:6 187:14 193:7 corrected 61:7 193:7 corrections 61:4 193:4 correctly 6:16 129:3 correspond 85:2 corrosion 11:12 14:13 165:21 counsel 5:7 40:10 80:5,13,16,22 103:21 124:13 126:24 127:16 154:2 couple 179:10 course 21:22 79:23 128:19 151:14 180:15 courses 15:13,22 16:1 17:21 21:7 court 5:14 6:6 50:6,8,13 70:10 courtroom 7:14 cover 102:19 covered 84:16 97:18 98:12 99:3 100:6 101:19 113:20 162:22 covering 15:14 115:7 116:7 126:7 covers 111:3 cracks 29:16 crash 141:5 cream 153:21,22 154:17,18,20 create 185:9 created 131:4	creates 129:16 critical 73:25 75:2 130:20 critically 129:20 cross 91:25,25 93:21,24 94:7 108:5 136:7 144:15 crpc 146:2 crystal 19:16,18 119:22 crystalized 188:17 crystalline 19:10 crystallographic 17:3 csr 1:21 52:21 62:25 194:25 cubic 13:2 19:13 current 10:6 108:5 currently 10:23 curves 159:11 cut 96:5 171:12 cv 30:21 cylinder 186:1,2	dates 144:25 david 3:16 5:25 49:14,22 50:6 54:16 90:13 174:23 191:22 davidson 3:15,15 6:2,2 54:15,15 day 58:14 61:8 62:20 193:8 194:20 days 25:21 deardo 1:13 2:12 4:3 5:7 6:4,9,15 6:17,18,20 24:10 24:20 27:3 40:9 48:2 52:13 53:12 55:3 56:9 57:9,23 61:2,13 70:9 80:12,19 89:7 90:12 100:24 111:9 124:12 169:7 179:23 191:3,18 192:5 193:2,13 deardo's 179:1 declaration 8:14 8:20,20 9:1,7 10:25 33:11 42:21 70:13 75:17 82:14 85:14 103:15 114:15 126:18 131:17 132:2,6 134:11,12 155:19 157:4 160:3 declarations 8:10 42:16 declare 61:2 193:2 declares 148:20 decreased 158:2 deeper 103:17
--	--	---	---

[defending - dion]

defending 41:18 42:1 defense 41:20 define 33:18,21 34:1,11 75:19 128:10 148:18 149:2 defined 25:22 27:4 89:17 103:2,6,8,10 114:4 defines 104:2 128:11 defining 127:20 definition 103:11 114:19,23 120:13 153:5,5 154:22 155:4,5 deform 159:15 181:24 deformation 11:5 11:19,22,23 12:8,9 12:20 13:9,15,21 14:7,21 15:16 16:15 20:5,5,7 26:1 58:24 59:3 69:8 131:11 138:8 139:10,14 143:22 157:13 158:1 183:25 184:5,6,17 185:16 186:8 deformations 12:1 deformed 188:19 188:20 deforming 12:10 degraisse 146:8 degrees 44:16 45:7 45:15 73:18 75:1 77:13,19 78:1,3,24 79:14 83:8,16 136:13,24 137:11 140:17 157:23	166:15 177:21,23 177:25 180:1,4,17 deliver 31:10 delivery 135:22 demarcation 18:13 dependent 160:8 depending 117:17 144:8 depicted 135:14 151:22 deposition 1:13 2:12 5:7,10 6:21 52:13 53:12 depositions 7:5 derivative 170:16 describe 90:2 116:6 166:9 170:3 172:20 described 20:17 73:15 83:24 97:7 98:25 102:4 104:14 116:1 136:22 describes 85:8 172:17 describing 21:13 66:10 68:15 97:1 97:16 119:10 description 42:7 98:15 105:3 115:23,25 175:23 175:24,24 descriptions 132:10 design 15:15 36:13 36:23 37:1,5,10,15 37:24 desired 27:10 73:10	despite 155:11 detail 73:16 determine 130:3 130:10 174:20 determining 86:23 developed 22:9 devices 35:13,20 35:23 36:3 diagram 12:5,6 147:10 151:1 diagrams 174:5 diameter 158:19 159:7 die 27:20 28:9,12 28:14,18 29:3,4,8 30:7 43:11 44:12 44:19,19,19,21 45:12 46:15 48:5 48:6 136:11 137:17,19 140:18 140:24 155:25 156:2,10,21 172:4 173:6 180:3,4,10 180:14 181:20,24 181:25,25 182:5 183:10,18,21 185:11 dies 27:18 136:5 172:2,2,5 181:18 183:21 186:5 difference 114:6,9 135:24 139:11 164:23 166:19 differences 152:14 different 13:6,12 13:22 19:9,10,18 19:19,20,22,22,24 20:2 86:19 87:15 88:22 89:24 90:20 91:3,20,22,23,24 92:1,4,11,18,20	99:9 100:10,11 101:6,8 102:5 103:3,4,6,8,19,20 104:15,15,16,18 107:23,25 109:16 109:18 110:2,8,14 111:12 112:9,11 114:1,2,24 115:2 116:16 117:3,4,8,9 117:17,24 118:1 118:10,11,18,19 119:7,17,25 120:9 120:14,15,16,19 120:19,20,21,22 120:24 121:15,18 122:5 123:17 136:22 145:7,22 146:23 147:1,16 147:22 148:12,13 148:19 149:2,7,9 149:16,25 150:6 150:11,13,16,25 151:10,12,19,21 151:21,25 152:2,6 152:11,17 153:7 153:23 154:3,5,11 155:12 164:9,19 164:20 165:1 166:9,11 172:13 182:25 difficult 96:24 148:4 149:21 185:15 186:22 diffuses 116:15 diffusing 108:7,23 diffusion 102:3 108:5 144:6 dimensional 184:25 185:1,2,3,5 dion 3:6 5:23 54:6
--	--	---	--

[dipped - equipment]

dipped 81:24 direct 24:6 29:12 47:23 57:7,20 58:5,13 59:14 60:3 117:6 118:4 118:14 125:15,21 126:4,13 127:10 128:17 130:25 135:10 153:9 154:9 162:6,18 166:5 167:11 177:17 178:4,11 178:20 180:6 182:7,20 183:14 183:19 184:15 185:24 187:11 188:10,25 189:10 189:22 190:2,16 190:25 directed 72:4 direction 62:12 108:16,17 165:25 176:22 194:12 directions 168:16 directly 33:2 73:21 disclose 104:13 110:1 disclosed 83:20 discloses 83:5 110:5,14 disclosure 38:22 discuss 49:12 80:4 124:13 discussed 120:23 discussing 8:18 28:20 77:7,12 133:6 134:18 179:23 discussion 23:23 100:19 175:7	dislocation 16:25 dissipation 158:5 158:11 distance 114:12 distinction 19:25 distinguish 152:11 distinguished 31:1 distinguishes 78:9 distributions 162:11 divided 113:12 doctor 123:25 document 30:22 49:8,12,17 51:2,2 56:13,15 60:15 63:14 133:5 157:1 documentation 147:5 148:3 163:5 documents 39:9 49:25 50:18 56:11 134:14 doing 10:18 24:23 47:17 79:8 134:4 152:4 159:23 175:13 184:13 doubt 79:8 doubts 147:8 dr 5:7 6:4,15,20 24:10,20 27:3 40:9 48:2 56:9 57:9,23 80:12,19 87:7 89:7 90:12 100:24 111:9 124:12 169:7 179:1,23 181:16 191:3,18 192:5 drafting 41:24 drastic 26:6 drastically 45:11 drop 45:24 49:13 49:21	drops 45:14 180:9 dual 18:25 19:9,13 ductile 170:24 ductility 187:5 due 139:13 158:4 158:10 dumped 142:8 dwelt 176:3,24	efforts 10:17 either 43:7 49:16 135:23 170:18,21 171:7 175:18 electrolytic 142:8 electron 94:19 95:3 121:3,7,8,11 121:13,25 122:1 148:2 electronic 122:7 electrons 96:15 element 12:21 14:10 elements 16:25 99:3 102:13 embargo 38:4 embodiment 65:12 67:9 81:5 82:6 85:8 97:10 101:4 113:19 168:5 177:13 employee 62:16 194:16 ends 71:9,10 130:12 energy 170:23 engineering 15:18 enjoyable 191:21 enormous 184:22 entire 69:11,20 93:2,23 130:11 160:25 161:4,17 162:1,15,19 163:2 entirety 81:15 168:12 entry 45:12 ep 158:25 equals 158:25 equipment 175:18 181:16 186:19
---	---	---	---

esq 3:6,7,8,16,17 54:6,7,8,16,17 essentially 122:17 establishing 34:17 estimate 45:16 et 38:8 39:10 41:25 83:3 etchant 92:5 etchants 91:23 92:1,3 etched 95:7,16 europe 42:3 evaluate 187:4 evidence 34:18 35:1,3,5 43:16 72:7 exact 98:19 100:4 100:8 exactly 15:4 93:25 105:19 141:3 149:4,4 examination 4:2 6:13 55:2 63:1 examined 6:11 example 16:8 21:20 22:5 29:17 30:3 97:7 98:1 111:1,4,10 112:6 112:21 117:11,15 119:5 155:25 168:7 174:5 182:11 187:1 examples 111:11 exceed 117:19 excellent 182:12 excess 71:19,22 exclusively 189:19 executed 61:8 193:8 exhibit 4:11,12,13 4:14 8:13,18 9:1,6	56:5,6,10 63:3,15 63:20 82:24,25 83:9 132:4,20 133:6 135:8,12 156:24 169:8 183:6 exhibits 4:9 55:9 131:20,21 existed 21:22 22:1 22:14,21 existing 39:22 exit 26:20 45:11 45:17 181:7 exits 29:4 expand 185:18 expands 158:17 expansion 159:9 expect 93:25 expenditure 170:22 expensive 37:21 37:22 38:8 experience 13:24 14:1,3,6 156:6 experiment 65:5 184:13 experimentation 165:16 experiments 163:25 164:2,8 expertise 11:4 13:25 71:1 explain 43:18 explained 84:2 179:25 explicitly 7:17 77:1 extent 49:16 external 108:3 eye 121:16	eyes 149:24 150:2 f f 6:1,1 176:23 face 81:6,20 faces 37:15 facility 146:16,16 fact 73:20 155:11 factor 73:21 75:2 75:7,9 factors 79:13 fair 7:18 58:8 103:18 179:8 fairly 182:10 fall 82:4 102:23 178:1 falling 159:22 familiar 131:21 133:17 familiarity 31:24 family 40:22 far 30:4 66:17 fast 171:19 189:13 faster 29:25 favorable 176:6 fcc 13:1 feature 79:11 features 91:23,25 feeling 25:15 ferrite 17:4,4,5 18:25 19:14 159:18,22,24,24 188:20,20 190:19 ferrites 190:22 field 13:24 23:3 108:5 128:11,12 137:6 figure 47:11 56:20 65:11 66:10 67:2 67:4,8 68:15 84:4 84:15,24 85:8,20 85:22 86:24 87:3	89:5 91:5,6,16 92:3,4,12,12 94:11 96:20 97:9 100:25 101:1,3 110:1,5,7 110:8,12,13,14 121:18 122:3,4,15 122:15,15 123:9 135:11,15,18,20 136:21 137:25 138:4,20,21 139:20 143:3 144:9,11,12,14 146:25 147:11,15 148:6,8 149:18 150:5,17,18 151:16,18 152:19 153:4,11 154:6 155:6 157:16 158:17 159:3,3,4,6 159:10,16,17 161:7 162:3 169:20 170:4,7 173:19 175:20,24 176:1,9 figures 91:20 92:17 95:6 96:13 122:16,19 123:12 filed 5:9 filling 86:21 final 16:22 43:21 44:20 66:22 67:2 67:4 69:13 130:10 141:1 164:11 190:18 financial 9:22 financially 5:17 62:15 194:15 find 9:6 26:14 38:15 39:16 44:14 95:3 105:12 121:10 124:20

[find - g]

135:11 170:5 fine 16:22 80:1 98:6 finish 7:25 79:23 141:25,25 167:18 finished 23:17 142:2 finite 36:15 37:7 finland 30:20 31:1 182:24 firm 5:13,15 6:2 first 8:13,14 13:23 16:20 17:19 41:2 41:2,2 42:8,23 59:20 66:24 96:19 96:19 115:13 119:15 125:4,12 126:2,5 135:19 157:11 166:3 172:8 firstly 57:13 63:19 five 40:1 47:1 80:2 83:8,16 124:2 136:1,13,23 140:17 144:7 170:25 171:25 177:23 178:1,13 191:8 flat 43:21 44:14 81:23 95:25 96:10 96:12 136:5 187:6 follow 101:14 167:5 followed 43:8,11 43:19 44:7,11 184:9 following 11:19 45:8 51:5 87:14 117:7 140:13 141:6 142:16 167:4 175:25	179:1 follows 6:11 97:11 101:5 foregoing 61:3 62:6,8,12 193:3 194:6,8,12 forging 184:25 form 21:19 22:3 22:23 23:12,22 24:5 25:7,20 27:15 28:1,19 30:8 33:19 34:6 36:10,24 37:11,17 38:1 39:3 45:9 46:6,25 47:8,15 48:15,18,20 49:3 58:12 59:5,13 60:2 64:24 65:20 66:20 67:3,14 68:5,17 69:6,17,25 70:5 72:6 75:4,10 76:9,19,25 77:6,21 78:4 79:4 85:9 90:10 91:1 94:2 96:3,21 97:20 98:13 99:5,11,17 100:7 101:20 103:1 104:4 105:1 105:21 106:9,19 107:2 108:13,25 109:2,7 111:14 118:13 119:13 120:4 123:18 128:4 129:2,9 130:6,14 139:18 143:20 144:4,18 147:3,18 148:14 149:19 150:8 151:23 152:20 153:8 154:23 172:9 176:12	181:15 184:4 185:4 formation 11:8 70:15,18 157:20 158:6,12 formed 18:6 43:21 73:23 136:10 170:21 172:9 forming 43:8,18 44:3,4,16 57:15,16 57:25 59:8 79:7 114:20 134:21 136:4 138:25 139:4 140:12 143:8,11,15 159:13,18,19 169:12,22,24 172:15,18,23 173:2,4,7 forms 27:13 143:14 158:16 forth 19:14 62:7 119:22 175:12 194:7 forward 38:6 145:16,19,20,21 found 74:5 foundation 28:1 28:10 72:25 96:3 137:1 138:2 149:10 154:7 163:21 166:22 174:21 185:12 four 41:17 73:10 78:15,16 83:12 84:7 85:11,20,25 90:7 91:3 98:2,16 101:6 104:13,15 104:16,18 110:2,8 110:14 115:2 116:15 128:23	129:1,7 130:22 151:20 152:19 153:7,13 154:6,21 155:2,6 173:21 187:2 fourth 36:13 152:23,23 153:16 fracture 15:17 170:23 free 71:19,22 french 60:5 68:1,3 70:3 133:18,22 134:4 135:21 146:12,13,15 frequently 63:9 front 8:23 full 17:19 56:6 82:16 187:25 188:22 189:16 fully 42:9 169:10 189:2,6,11,12 190:7,21 function 176:2 funding 10:11 furnace 23:16 26:20 43:24 44:15 44:17 45:12,18 83:22 135:25 136:23 144:8 155:24 156:2,9,21 163:18 171:17,17 171:18 176:2,3 180:13 181:7,18 181:24 185:11 furnaces 63:10 further 62:12,14 194:12,14
			g
			g 33:7,7,7,7 146:10 176:23 183:22

galvanizing 18:7 gas 182:10 gauge 37:18 177:4 177:10 gears 131:15 173:13 general 83:5 105:9 105:12 generally 14:22 16:6 19:12 23:2 32:17 83:8 generating 12:19 generic 24:12,15 geometry 176:23 getting 28:25 34:20 41:11 159:17,21 185:22 give 7:11 16:24 50:11,15 72:12 73:14 84:21 90:13 98:1 103:13 110:20 154:1,3 166:19 168:16 178:7 179:15 187:21 191:7 given 31:10 192:4 gives 79:2 87:11 87:14 100:9 123:1 140:3 176:21,21 glantz 3:24 5:13 54:24 gleaned 38:21 gleeble 183:22,24 183:25 184:12,13 184:24 186:3 go 7:5 10:15 13:25 17:14 24:10,20 27:3,23 30:11,21 33:10 35:6,25 47:16 57:1 58:25 66:2 79:21 82:13	96:2 105:5 110:10 110:21 111:9 114:14 121:3 123:21 124:24 126:18 127:19 132:21 141:11 148:1 160:2 168:3 170:6 175:8 178:25 179:1,12 186:8 187:20 188:3 192:1 goal 23:1 god 174:13 goes 14:5,7 81:24 128:17 170:19 171:17 going 5:5 8:14 9:1 18:18 39:24 42:18 45:10 49:11,24 50:1 56:9 58:15 97:2 101:22,23,24 107:20 108:6 120:6,7 132:20 141:1 143:18 147:13,17 149:8 149:17 150:6,17 151:20 152:21 154:2,3 163:1 165:24,24 171:16 171:20 177:20 189:4 good 5:4 6:15,18 18:12 19:24 72:20 103:17 124:1 166:7 174:16 177:1,1,2,11 178:21 182:11 grad 92:17 grader 150:10,15 150:24 151:7,9,14 151:17 152:10	grades 152:11 graduate 10:16 15:13,21 16:1 31:10 grain 13:18 16:8 16:14,20 17:6 139:13 grasp 36:20 37:3 gray 152:9 great 8:22 124:5 191:17 green 186:4 grinding 96:9 group 9:21 32:4,7 groups 33:6 guaranteed 134:22 140:12 guess 23:15 178:22 guidelines 117:8 gutter 136:7 gwangyang 33:7	h	h 16:10,10 33:7 88:9 91:23 132:25 133:1 141:18 176:20,23 177:9 half 123:23 168:23 hall 16:9 hand 56:10 157:6 handbook 105:6 handle 174:15 180:4 handy 132:23 hang 170:5 happen 28:4 159:25 174:4 177:19 happened 130:5 happening 138:14	happens 29:3 178:16 hard 94:24 95:24 174:9 175:4 hardening 16:25 17:4 hardest 188:14 hardness 97:6 100:11 112:25 113:2 117:19 heading 141:12 hear 70:10 80:17 80:19 100:14 146:21 heard 15:8 106:17 heat 12:13 16:11 16:16 20:3,4,6,8 20:11,14,17,24 21:2 44:2,6,6 45:7 46:5,8,13,17,22,24 47:2,5,14,20 48:3 48:9,13,20 49:1,6 57:16,17,22,24 58:1,9,11,15 59:12 59:16,25 60:7,10 60:13 63:6,25 64:3,20,23 65:5,13 65:18 66:5,14,16 66:18,24 67:10,12 67:13,19,21,22 68:3,10,15,19,20 69:1,15,24 70:4 84:25 116:8,13,14 130:19 138:24 139:3,10 140:1 142:11,18,22,25 143:18,21,24 169:11,22,23 172:8,9,14,20,25 173:2,3,18 177:25 179:25 186:6
--	---	---	----------	--	---

187:4 heated 20:20,22 20:25 21:17 22:21 23:3 27:10,14,14 27:17,18 44:15 47:1 136:1 170:25 171:18,19,22 172:11 177:25 187:5 heating 12:9,18 23:19 24:2,12,12 24:15 25:6,10,12 25:16 26:7,11,13 26:20 47:5,25 48:4,11,25 58:2 64:5,5,6,11,17 68:21 69:4,8,13,21 73:7,8,12,17,25 74:5,9,12,20,25 75:17,21,22,25 76:6,7,13,16,22 77:9,13,19 78:1,2 78:10,17,19,20,24 79:13 83:20 84:6 84:10,11,11 129:15,19 130:20 131:4,7 137:10,12 138:16 143:12,14 143:22,24 163:17 166:9,13,14,17 173:6,7 176:14,15 185:15 186:6 heavier 18:19 height 94:8 held 5:10 43:25 175:5 helium 182:11 help 103:15 helping 41:12,20 41:23,24	helps 128:10 hereto 61:6 193:6 high 12:24 17:23 18:2 20:5,7 21:14 23:1 43:4 57:14 138:8,12,22 159:14 182:10 189:3,13 higher 37:18 180:2 highlight 92:4 highly 188:19 hindsight 38:16 39:17,21 hold 13:20 32:24 168:2 holding 48:11 58:2 144:1 173:8 homogeneous 19:3 homogenous 119:21 honorary 31:9 hopefully 8:22 horizontal 147:2 147:16 148:13 151:13,21 152:18 153:3,6 hosang 3:8 5:24 54:8 hot 11:4,19,22,23 12:7 13:9,15 14:6 14:21 16:15 20:20 20:23 21:8,12,17 21:20,21,25 22:10 22:14,18,20 23:11 23:25 24:21 25:2 25:5,12 28:5,21 29:5 30:4,9 43:6 43:10 44:11,19,20 46:9,12,14,18 47:6 47:17,24 48:3,4,6	56:25 57:15,16,25 59:8,10,17,17 60:6 65:4,22 66:10,13 66:19 68:20,23 69:8,23 81:24 134:21 135:23 136:4,10 138:24 139:4,13 140:11 142:11,18 143:1,8 143:11,15 169:12 169:22,24 170:18 171:7 172:2,11,15 172:18,23 173:2,3 174:8,25 177:3,4,7 179:24 182:13 183:25 184:5,6,9 184:10,16 186:17 186:20,20,23 hotter 45:7 hour 7:23 39:24 79:22,25 123:23 124:3 167:17 168:24 hourman 132:25 133:21 hours 174:24 187:2 house 24:23 hpf 57:13,17,22 hudin 133:1,21 huh 87:23 97:4 110:17 114:17 136:8 137:18 139:8 158:21 165:23 170:12 174:11 175:2 177:8,12 human 121:16 hundred 29:14 hv50g 112:25 117:20	hypothetical 137:1 154:8 163:22 178:20 185:13 i i.e. 83:7 idea 87:11,12,14 87:18 91:21 107:6 141:21 145:17 146:3,11 identifiable 36:16 37:7 identify 150:25 151:19,20 153:7 154:6 identifying 89:25 illustrate 59:8 illustrates 65:11 67:8 84:24 image 94:11,14,18 95:20,24 97:3 123:1 145:3 146:7 148:2,10 imaged 96:14 images 95:6 122:23 imagine 15:1 28:4 120:11 152:18 174:4 imaging 96:17 immediately 106:8 181:23 imparting 184:22 impinged 182:10 implicitly 77:3 implies 68:20 implying 118:22 importance 76:5 78:15 important 67:15 73:12 75:17 126:6
--	---	--	--

129:19,20 171:20 improve 35:13,20 35:23 36:7 improving 11:11 14:13 inches 93:19 include 15:1 17:20 20:18 38:21 58:1 75:9,20 143:19,24 181:6 190:10,13 included 13:9,14 58:10 190:18 includes 11:4 20:12 69:8,14 143:11 187:25 188:21,23 189:16 189:19,24 190:9 including 9:24 15:14 20:14 81:9 81:13 83:1 130:20 168:10 incomplete 136:25 154:8 163:22 178:20 185:13 increases 158:24 159:20 independent 122:24 127:7,14 128:8 index 4:1 55:1 indicates 29:25 induced 159:18,24 159:24 industries 17:22 industry 29:19 104:25 inferior 85:5 influence 42:15 76:8 information 97:1	inherently 77:12 initialed 61:5 193:5 injury 7:3 ink 61:5 193:5 inland 10:1 instantaneously 144:4 institute 31:18 instructed 34:15 126:24 instructions 167:4 167:5 interacts 119:15 interchangeably 112:20 intercritical 12:5 interdiffusion 85:3,23 86:2,16 87:21 94:15 98:3 98:25 102:21 104:19,22 105:7 105:15,19 108:4 108:11,20,22 109:14 111:20,24 112:4,12,19 113:10 160:15 166:20 167:6,8 168:18 interest 170:15 interested 5:17 15:6 62:15 194:15 intermediate 94:16 98:8,18 99:1,8,14 100:5,13 101:11,17,18 102:14,22 104:19 104:22 106:4,8,18 107:9,12,15 109:4 109:10	intermetallic 63:7 85:4 86:18 87:25 89:19 98:9 99:1 104:20,23 107:18 107:19,21,22 109:14,15,16 111:20,23 112:5 112:13,20 113:10 120:6 121:2 interparty 7:8 interpret 112:24 interpretation 88:20,21 interstices 28:11 introduce 49:8 introduced 18:11 invention 38:20 39:2 65:12,19 67:9 74:1 75:19 84:6 85:2 106:25 inventive 79:11 inventor 41:6 inventors 66:17 investigate 136:18 involve 20:4,6 32:3 involved 41:7,10 76:10 95:14 127:11 163:19 186:17 involves 60:6 78:15 involving 21:8 ipr 8:3,4 10:19 ipr2019-01275 1:7 2:7 52:7 53:7 iron 12:6,25 19:8 87:24 98:4 108:16 108:19 117:16 119:6	issue 8:6 89:23 171:20 issues 23:23 item 11:16 j j.p. 133:1 jelly 115:14,17 job 1:22 52:22 187:4 journal 148:18 149:1,5 june 1:14 2:15 5:1 5:5 52:14 53:15 62:20 194:20 justified 175:7 k kappel 3:15,17 6:1 6:2 49:21 54:15 54:17 kathleen 1:20 2:15 52:20 53:15 62:24 194:24 kathy 5:15 50:11 191:23,24 keep 176:15 keeps 141:5 kefferstein 41:3 47:17 56:23 59:7 106:21 key 73:21 75:2,7,9 79:13 114:25 kid 149:6 kilovolts 145:12 145:13 kind 173:14 175:18 kindergarten 149:6 knew 37:6 38:6 174:3
---	---	---	--

know 7:4,25 11:2 12:24 19:25 30:4 30:14 31:17 32:20 33:15,24 39:9 40:23 41:13,15 46:7,7 49:9 60:4 66:15 68:9,10,14 89:23 92:9,13 95:10,12,13,23 100:3 105:19 106:8,12,18,20 107:1,8 108:19 110:7,13 116:1 118:1,5,23 119:9 120:11 123:21 125:12 128:11 131:13 132:23 133:11 145:24 147:6,15,23,23,24 148:1,7 149:21 150:9 154:24 160:5 163:23 164:4 165:19 166:24 167:14,16 174:23 178:22 181:13 182:16,18 182:23 183:5,8 184:12,20 186:15 187:18 knowledge 38:17 38:21,25 39:8,18 39:22 known 35:12,19 35:23 36:7,19 37:3,23 69:15 83:7 104:24 knows 174:13,14 korea 31:5	I I 16:10,10 133:1 145:15 183:3,22 183:22 lab 15:3 156:6 181:17 183:11 184:20 186:19 labeled 86:2,22 91:7 94:15 135:15 177:9 labels 87:1 88:24 laboratory 96:4 182:9 large 158:24 late 123:22 laurent 133:1,21 layer 72:1,4,8,9,14 72:19 83:12 84:7 85:4,4,11,23,24,25 86:3,3,4,10,11,12 86:17,18,21,22 87:21 88:4,7 89:17,19 94:8 97:21,25 98:3 99:1,1,1,2,8,9,14 99:15 100:5,5,13 101:11,11,13,17 101:18,19,22 102:5,15,15,21,21 102:22,22 103:3 103:19,19 104:3 104:22,23,23,23 105:7,15,19 106:4 106:8,18 108:11 108:22,25 109:4 109:11,14,14,15 109:17,21,22 111:20,20,23,24 111:25 112:4,5,12 112:13 113:6,10 113:11 114:2,3	115:1,3 116:13,14 116:24 117:2,3,16 117:24 118:12 119:6,18 120:10 120:14,15 121:5,6 121:19 129:7 130:22 152:15,17 152:23 153:2 154:17,18,21,22 155:5,6,12 160:11 160:16,23 161:3 161:25 162:1,12 162:21 163:16 166:3,20 167:6,9 168:6,17,18 173:21,25 174:2 layered 115:2 128:23 129:1 176:16 layers 72:22,23 73:3,10,13,22 77:8 77:12 78:15,16 79:3,7,12 85:3,21 85:25 86:8,9 87:2 87:25 89:2,11,22 90:8,18 91:8 93:25 96:20 97:2 97:10,17,18 98:2 98:16,19 101:2,5,6 101:7,19 102:14 102:20 103:2,6,20 104:13 109:12 111:13,19 112:9 113:3 114:1,4,19 115:15,21 116:8 116:16 117:8,9 118:6,19,23 119:19 120:19,21 129:16 131:4 147:14 149:15 150:25 151:10,19	151:21 152:16,19 153:7,13,18,23 154:4,6,11,14,19 154:20 155:3,3,6 155:15 163:9,12 164:11,24 165:5 174:20 lead 179:1 leads 17:7 120:2 learn 135:18 learned 39:12 leave 23:16 156:21 leaving 71:19,22 156:9 lee 3:8 5:24 54:8 left 135:22 139:6 140:8 144:25 170:13 legal 40:23 41:15 41:15 length 186:10 level 21:14 38:18 38:25 72:2,14,18 levels 23:2 lewis 3:5 54:5 liability 7:3 light 86:16,18 87:22 88:1 90:3 90:22 lighter 37:19 38:8 90:23,25 limitation 127:2,8 127:15 128:8 limitations 163:20 limited 34:5 limits 126:6 line 7:25 18:13 35:8 63:4,24 64:10,14,15 65:7,8 67:7 70:13 71:3,4 71:7,7 72:13,17
		115:1,3 116:13,14 116:24 117:2,3,16 117:24 118:12 119:6,18 120:10 120:14,15 121:5,6 121:19 129:7 130:22 152:15,17 152:23 153:2 154:17,18,21,22 155:5,6,12 160:11 160:16,23 161:3 161:25 162:1,12 162:21 163:16 166:3,20 167:6,9 168:6,17,18 173:21,25 174:2 layered 115:2 128:23 129:1 176:16 layers 72:22,23 73:3,10,13,22 77:8 77:12 78:15,16 79:3,7,12 85:3,21 85:25 86:8,9 87:2 87:25 89:2,11,22 90:8,18 91:8 93:25 96:20 97:2 97:10,17,18 98:2 98:16,19 101:2,5,6 101:7,19 102:14 102:20 103:2,6,20 104:13 109:12 111:13,19 112:9 113:3 114:1,4,19 115:15,21 116:8 116:16 117:8,9 118:6,19,23 119:19 120:19,21 129:16 131:4 147:14 149:15 150:25 151:10,19	151:21 152:16,19 153:7,13,18,23 154:4,6,11,14,19 154:20 155:3,3,6 155:15 163:9,12 164:11,24 165:5 174:20 lead 179:1 leads 17:7 120:2 learn 135:18 learned 39:12 leave 23:16 156:21 leaving 71:19,22 156:9 lee 3:8 5:24 54:8 left 135:22 139:6 140:8 144:25 170:13 legal 40:23 41:15 41:15 length 186:10 level 21:14 38:18 38:25 72:2,14,18 levels 23:2 lewis 3:5 54:5 liability 7:3 light 86:16,18 87:22 88:1 90:3 90:22 lighter 37:19 38:8 90:23,25 limitation 127:2,8 127:15 128:8 limitations 163:20 limited 34:5 limits 126:6 line 7:25 18:13 35:8 63:4,24 64:10,14,15 65:7,8 67:7 70:13 71:3,4 71:7,7 72:13,17

76:5 79:23 84:22 93:4 97:8 110:21 111:18 112:8 117:11 124:18,25 138:20 167:18,24 168:4 171:9 189:3 lines 18:8 81:1 84:3 liquation 174:6 liquid 28:8 list 11:16 12:22 13:25 14:10 16:3 30:16,18 133:9 listed 81:14 140:19 168:11 listing 111:19 lists 101:2,6 litigation 41:8,21 little 15:25 28:12 40:1 56:7 73:16 79:20 90:13 94:1 97:14 103:16 123:7 131:15 157:15 158:23 169:21 173:13 180:1 182:15 185:18 llp 3:5 54:5 loaded 147:14 located 86:19 101:25 location 81:5,19 82:3,6 97:16 114:13 locations 33:8 82:7,10 98:23 logical 164:18 logically 164:22 long 10:2,4 13:21 21:22 32:1 38:16 45:17 65:21,21	166:18 look 15:12 16:20 16:21,23 21:5 38:11 47:16 63:3 63:4,24 64:9 65:7 66:24 70:12 71:2 71:16 72:13,17 74:22 76:2,2 77:22 78:5 84:18 84:22 85:22 87:24 90:9 91:19 92:20 96:20,23 102:9 104:5,9 105:6 110:7 117:11 131:16 139:20 143:3 144:9 146:25 150:10 151:9 152:11,23 153:16 155:8,18 156:24 157:6 167:22 175:20 180:20,20 187:18 190:17 looked 66:22 92:17 93:23 104:10 118:7 131:2,14 looking 17:16 18:4 39:22 59:16 74:7 74:8 79:6 86:16 86:18,23 87:7,18 92:18 94:11 95:15 96:7 97:3 99:19 103:16 104:7 122:13,17,19,23 123:1 145:7 147:5 147:10 148:5,10 149:21 150:5,15 151:17 152:7 153:3 156:6 159:2 159:4,23 169:20	178:8 184:21 188:4 looks 88:16 90:2 90:20 91:3 92:11 121:15 136:6 lot 32:4 75:16 147:4,7 170:22,23 170:23 low 16:6,24 43:22 71:24 72:15,18 lower 44:22,23 99:2 172:7 lowest 99:19 lunch 123:21,23 124:8 m m 11:10 44:25 132:25 146:9 156:25 m50 44:25 45:2,4 machine 62:11 184:5,6,17 194:11 magic 79:10 mail 50:5,9,11,13 50:21,23,24 maintain 19:14 majority 35:5 maker 25:1,2,4 making 37:24 manages 79:12 manufactured 43:6 mark 49:11 50:1 56:9 marked 4:9 55:9 market 36:14,25 marron 146:8 martensite 11:9 17:5 19:1,15 21:19 45:3,5 157:20 158:5,11	158:15 159:19,21 188:12 189:4 190:8,10,14,19 martensitic 171:1 185:9 187:25 188:7,22 189:7,11 189:17,20 190:7 190:21 material 19:11,17 22:16 29:15 48:19 86:17,20 88:3 89:18,19,20 103:20 108:7,8,23 108:23 115:3 117:3,24 119:23 120:1 122:2 123:4 123:7,10 141:17 152:17 153:19,23 154:14 177:6,10 materials 8:23 19:6,23 103:3,19 114:25 117:8,9 122:5 123:15 149:14 mathematics 171:11 matrix 19:8 21:15 88:2 109:19,20 matter 5:8 mean 9:20 14:16 15:3 17:7 19:5 22:11 26:10 29:22 35:4,18 36:23 39:2,21 41:10 44:24 46:11 47:16 48:17 57:18,22 71:22 73:2 81:18 84:10 91:9 96:16 97:5 100:8 102:8 103:8 104:15 105:11,12 106:25
--	---	--	--

107:1,6,19 108:2,4 108:22 109:5 110:2,8,14,25 112:4 114:2,7,10 114:11,24 115:5 117:4,8,9 119:8,23 119:24 120:2,11 120:14,16,20,22 120:23 121:5,6,7 121:10,17 122:1,8 122:12,14,17,20 122:22 123:13 127:20 137:8,12 137:14 148:21 152:21 153:12 154:10 156:17 158:9 159:17 162:1 163:23 166:24 173:11 174:16,19 188:23 meaning 29:21 105:6 107:9,11 114:9 125:24 178:25 means 11:24 43:20 45:8 77:8 82:7 87:24 103:3 107:22 108:3,12 118:2 119:1 128:2 137:5 145:17 146:11 150:12 153:3 159:19 160:24 162:15 189:17,25 190:8 meant 57:24 measuring 159:11 mechanical 43:23 134:18,20 138:23 139:21 140:2,4,11 mechanism 27:13	mechanisms 15:16 16:4,4 media 5:6 192:5 medium 28:13 meet 177:12 meeting 5:18 melted 70:22 174:7,8 melting 71:24 memory 7:6 mention 128:2 167:15 mentioned 7:9 13:12 17:10,12 18:21 21:20 22:16 44:18 101:7 102:24 130:21 mentions 70:14 126:15 metal 17:11,12 105:18 metallic 85:24 86:3,12 88:7,17 94:16 metallurgical 25:22 105:13 188:12,13 metallurgy 105:6 metals 101:8,17 102:14 107:23,25 109:16,18 method 16:11 36:7 141:16 methods 35:13 36:3,5 mic 24:8 100:16 micro 93:12 147:24 micrograph 86:24 87:19 88:13 91:8 93:6 95:16 144:15	144:21 150:7,18 150:19 151:11,17 151:18 micrographs 93:2 122:17,18 144:24 micrometer 145:8 162:4 167:6,8 168:8,17,18 micrometers 81:9 81:11,15 82:8,11 160:12,17,24 161:1,25 162:14 162:21,22 163:1 168:7,13 micron 94:7 microns 93:10,15 93:16 165:21 micros 122:13 microscope 94:19 95:4 122:1,7 microstructure 11:8 12:1 188:13 microstructures 122:14 mid 174:6 middle 88:18 90:5 90:24 100:1,4,9 101:15,23 177:21 miles 87:7 mill 3:9 54:9 170:18,19 millimeter 177:6 millimeters 93:16 176:5 177:3,5 millions 100:2 mind 22:5 49:11 124:17 176:8 187:16 minute 20:11 40:1 50:25 73:14 80:2 156:23 176:24	178:17 minutes 47:1 83:9 83:16 124:3 136:1 136:14,23 137:10 140:18 144:7,7,7 156:1,5,10,17 170:25 172:1 177:23 178:1,13 178:17,18 179:11 179:15 191:8 mischaracterizat... 27:16 43:15 46:20 66:8 68:16 70:6 74:14 78:13 79:5 79:16 89:16 102:7 111:7 112:2,16,23 113:15,23 116:17 121:21 122:10 132:12 150:22 151:3 161:12,20 165:8 179:6 mischaracterize 156:13 mischaracterizes 25:13 72:7 75:3 75:23 89:4 103:24 129:17 142:13 mischaracterizing 45:25 misleading 97:14 misrepresentation 77:15 missing 30:18 misunderstood 41:9 mixed 86:13 122:5 mixing 17:11,11 mixture 19:5,7 107:22 mm 21:15 135:6 170:16
---	---	--	--

[modern - observation]

modern 18:14 modifications 37:9 moment 23:16 89:23 90:19 109:25 121:25 152:19 154:1 money 10:8,15 32:14,16 morgan 3:5 54:5 morning 5:4 6:15 morphology 73:22 mount 88:15 mounted 96:5 move 39:25 50:18 155:15 moved 27:11 28:8 moving 108:16,17 134:14 mpa 43:5 48:19,19 171:3 191:2 multiphase 18:6 18:21,23 multiple 121:18 mute 49:19	near 43:22 72:1 160:1 necessary 83:11 need 7:24 36:14,23 37:1,5,10 49:17 50:8 68:19 117:4 146:12 154:4 167:7 177:13 179:11 needed 146:13 needs 37:15,24 103:20 115:2 160:25 neither 62:14 194:14 never 15:2,8 47:5 48:10,13,25 59:11 66:3,4 133:13 187:3 new 3:19,19 18:4,9 39:23 41:23 54:19 54:19 77:20 120:5 nice 135:19 191:18 nicholas 3:24 5:13 54:24 191:23 nitriting 14:17 normally 45:14,17 179:25 noted 61:5 193:5 notes 179:12 notice 112:25 noticing 5:22 nugget 70:14,18 71:14,16,17 176:22 177:1 number 4:10 10:24 15:5 36:15 37:7 55:10 63:4 82:25 98:5,11 101:15,15,16 145:24 192:5	numbers 81:13 83:1 162:10 168:9 168:11	107:2 108:13 109:2,7 111:6,14 112:1,15,22 113:14,22 115:19 116:17 117:5 118:3,13,20 119:13 120:4 121:20 122:9 123:18 125:14,20 126:3,12 127:9,17 128:4,16 129:2,8,9 129:17 130:6,14 130:24 131:6 132:11 133:25 136:15,25 138:1 139:18 142:13 143:20 144:18 146:18 147:3,18 148:14,14 149:10 149:19 150:1,8,21 151:2,23 152:20 153:8 154:7,23 156:13 158:13 161:11,19 162:5 162:17 163:10,21 164:12 165:7 166:4,22 167:10 169:13 170:1 173:5 174:21 176:12 177:16 178:3,10,19 179:5 180:5,12 181:15 182:6,19 183:13 184:4,14 185:4,12 185:23 187:10 188:9,24 189:9,21 190:1,15,24 objections 5:20 90:14 observation 129:24 157:21
n		o	
n 11:6,10,11 33:7 33:7,7 82:20 91:23 131:10 132:25,25 133:1,1 133:2 146:8,9 156:25 naive 174:18 name 5:11,13 6:16 30:25 31:14 62:18 132:17 194:18 names 90:9 104:17 104:19 112:9 133:15 narrative 169:14 nature 73:22		o 6:1 33:7 82:20 132:25,25 133:1 141:18 142:12 146:8,9 156:25 183:3 oath 6:10 7:12 62:9 194:9 object 23:12 25:7 27:15 28:19 objection 22:3,23 23:22 24:5,16 25:13,20 27:1 28:1,10 29:11 30:8 33:19 34:6 36:10,24 37:11,17 38:1 39:3 45:9,19 45:25 46:6,19 47:8,15,22 48:15 49:3 57:6,19 58:4 58:12,22 59:5,13 60:2 64:24 65:20 66:7,20 67:3,14 68:5,12,16,17 69:6 69:17,25 70:5 72:6,25 74:3,13,21 75:3,10,23 76:9,19 76:25 77:6,15,21 78:4,12 79:4,15 81:21 85:9 89:4 89:15 90:10 91:1 92:6,14,21 94:2,2 95:8 96:3,21 97:20 98:13 99:5 99:11,17 100:7 101:20 102:6,25 103:24 104:4 105:1,21 106:9,19	

[observe - paragraph]

observe 91:22,24 observing 151:12 obtain 79:12 obtained 64:11 138:24 140:13 obvious 35:15,21 36:1,6 obviously 49:17 70:11 158:4,10 171:18 174:16 obviousness 38:15 39:17 127:4 occur 13:7 14:20 28:7 73:6 91:14 116:8 186:20 occurred 24:1 90:1 140:22 occurring 182:4,5 occurs 29:2 44:2 73:7 136:2 181:14 october 14:1,2 25:11 30:5 47:6 47:13 106:17 office 1:1 2:1 5:10 41:12 52:1 53:1 oh 6:24 10:4 71:11 170:6 187:21 oil 28:16,17,20,22 28:23 29:8,17 38:4 okay 6:25 7:4 8:4 8:7,15,19,25 11:1 11:21 17:15 20:10 22:20 29:25 33:14 35:11 38:12 42:2 42:6,18,22 44:10 49:19,21 50:22,23 50:24 51:1 56:16 56:18 57:12 63:17 63:17,17,24 65:9 67:22 71:11 74:15	76:4,7 80:3,24 81:2 82:15 83:3 85:14,17 86:15 93:9,11 97:24 98:6 102:12 104:7 104:18 105:10,11 109:21 110:21,22 111:18 112:7,19 114:18 119:17 124:4,16,21,23,25 126:22,22 131:15 131:18 134:13,15 135:9,21 139:7 143:4,5 144:10,24 146:7 151:24 152:10,15 155:14 155:19,21 157:10 158:17 159:5,8 160:4,6 161:24 167:23,25 168:3 168:21,25 169:25 170:6,8,13,17,24 171:4,6,14,15 172:10 173:10,10 173:11,24 174:8 174:13,15 175:20 176:13,18 177:4 179:14 180:20,22 180:25,25 183:9 185:25 186:10 187:17 188:6,11 189:8 191:3 older 18:13 once 7:23,25 9:6 49:14 140:22 178:25 179:1 ones 145:7 open 50:21 60:15 126:25 132:20 134:20	operations 156:7 opinion 34:22 74:23 75:15 78:6 78:8 92:23 106:13 118:15,17 142:9 142:10 opinions 42:15 114:20 132:2 opposed 25:1 184:25 options 36:19 37:3 order 11:22 32:17 49:18 156:22 177:12 ordinary 37:2,6 38:18 39:1,5 47:13 66:4 74:10 74:19 106:14,16 106:24 107:5 109:6 181:2 original 91:6 163:13 oulu 183:2 outcome 5:17 163:8 outdated 15:25 outer 72:4 89:2,12 109:22 outside 84:11,13 93:5 162:24 178:14 179:2 oval 137:8,14 139:7 overall 48:12 66:18 143:15 owner 1:9 2:9 3:13 34:7 52:9 53:9 54:13 91:6	p p 6:1 16:10 33:7 88:9 141:18 p.m. 2:14 53:14 124:9 169:1,4 179:17,20 191:11 191:14 192:4 page 3:9 4:10 17:16,17 30:23 35:8 54:9 55:10 56:16,17,20 71:3 103:14 114:14,15 126:20,21 135:11 139:20 141:7 157:6,7 170:11 pages 1:24,25 52:25 paint 141:18,21 142:5 painted 141:7,13 painting 14:24 141:23 142:8 palo 3:10 54:10 paper 82:23 148:17,25 183:6 186:14 paragraph 10:24 13:23 14:11 15:5 15:12,25 17:14,17 21:6 30:11,13 33:10,12 34:14 35:6 38:11 42:6 42:20 47:3 65:3 70:12,14 71:2,6,8 71:18 73:15,17,20 82:2,13 84:1 85:15 104:5,7,9 109:24,25 110:18 114:14 126:18,23 131:16,17 132:1 134:9 138:20
---	---	--	--

139:21 140:10 155:18 157:12 160:2 173:15,16 180:21,23 parameters 78:22 163:7 166:2,10 178:14 179:2 part 13:14 16:13 16:13,14,18 20:22 21:1,3 27:23 29:4 31:13 43:8,10,19 44:10,11 46:3,4,12 46:25,25 47:5 64:20 65:13 67:10 69:1,2,13 70:19,21 70:22 72:5 73:10 88:8 94:14 120:6 125:12,16 126:5 127:22 128:20 142:11,18,20,20 142:22 143:14,18 160:20 164:7 172:3 173:3 184:10 partially 175:10 particle 16:23 particles 16:22 17:7 particular 22:4 67:20 98:3,22,23 111:1 188:16 particularly 176:6 parties 24:24 62:16 194:16 parts 15:10,11 29:19 64:11 141:7 141:13 142:3 143:2 party 5:16 24:22 25:5 49:16 175:3	patent 1:1,2,7,9 2:1,2,7,9 3:13 5:9 6:25 8:6,6,8,8 10:22 20:18 21:13 21:21,23 22:1,15 22:21 23:20 24:2 24:11 25:24 26:2 26:5,15,17,19,24 33:18,21,22,24 34:1,4,7 40:13,18 40:20 41:3,7,10,11 41:11,16,18,20 42:7,9,11,15,19 47:17 52:1,2,7,9 53:1,2,7,9 54:13 56:23 59:7 60:10 63:3,16,23 64:3,22 66:17 72:3 76:3 78:9,10,14 79:2,10 79:11,13,21 80:25 81:18 83:24 84:2 84:5,16 85:7,19 88:25 91:6 97:8 102:4,12,13 103:10,11 104:2 104:12 106:21,23 108:10 109:5 110:1,10,11,23 111:3,11 114:5 115:25 116:2,4,18 117:25 118:9,17 118:25 124:16 127:21 162:3,13 166:9 167:2,3,7,14 168:16 174:3,6 175:21 176:9 187:15 patentable 34:23 34:24 patents 10:22 20:10 39:9 40:21	41:6,12,24 59:15 peak 144:2 peanut 115:11,11 115:13,16 peer 148:18 149:1 149:5,13 penalty 7:12 61:3 193:3 people 24:11 29:13 38:6 147:6 percent 45:5,14 98:4,4,7 189:4 190:8,9 performance 57:14 performed 63:10 period 68:21,24 134:22 144:1 perjury 7:13 61:3 193:3 permissible 38:15 39:16 permitted 34:8 person 36:18 37:2 37:5 39:5 47:12 48:24 66:3 74:10 74:18 75:8 92:16 105:17 106:7,13 106:16,24 107:5 109:5 136:20 153:3,4 156:18 181:2 personal 7:3 perspective 39:23 pertain 39:4 petch 16:9 petitioner 1:6 2:6 3:3 5:8 7:8 31:21 34:16 52:6 53:6 54:3	petroff 3:16 5:25 5:25 18:17 22:3 22:23 23:12,22 24:5,16 25:7,13,20 27:1,15 28:1,10,19 29:11 30:8 33:19 34:6 36:10,24 37:11,17 38:1 39:3 43:15 45:9 45:19,25 46:6,19 47:8,15,22 48:15 49:3 54:16 57:6 57:19 58:4,12,22 59:5,13 60:2,19 64:24 65:20 66:7 66:20 67:3,14 68:5,12,16 69:6,17 69:25 70:5 72:6 72:25 74:3,13,21 75:3,10,23 76:9,19 76:25 77:6,15,21 78:4,12 79:4,15,22 80:3 81:21 85:9 88:9 89:4,15 90:10 91:1 92:6 92:14,21 94:2 95:8 96:3,21 97:20 98:13 99:5 99:11,17 100:7 101:20 102:6,25 103:24 104:4 105:1,21 106:9,19 107:2 108:13 109:2,7 111:6,14 112:1,15,22 113:14,22 115:19 116:17 117:5 118:3,13,20 119:13 120:4 121:20 122:9 123:18,25 125:14
---	---	--	--

125:20 126:3,12 127:9,17 128:4,16 129:2,8,17 130:6 130:14,24 131:6 132:11 133:25 134:7 136:15,25 138:1 139:18 142:13 143:20 144:18 146:18 147:3,18 148:14 149:10,19 150:1,8 150:21 151:2,23 152:20 153:8 154:7,23 156:13 158:13 161:11,19 162:5,17 163:10 163:21 164:12 165:7 166:4,22 167:10,17,20 169:13 170:1 173:5 174:21 176:12 177:16 178:3,10,19 179:5 180:5,12 181:15 182:6,19 183:13 183:19 184:4,14 185:4,12,23 187:10 188:9,24 189:9,21 190:1,15 190:24 191:7,10 191:16 ph.d. 1:13 2:12 4:3 6:9 52:13 53:12 55:3 61:2,13 175:13 193:2,13 phase 12:5,6,25 18:25,25 19:2,3,9 19:13,20 88:8 119:20 120:5 137:6 174:5 181:19	phases 19:9,22,24 117:4,17 118:1,6 118:10,18,22 119:7,17,25 120:1 120:9,15 photograph 151:22 photos 156:7 physical 33:8 picture 95:16 147:10 149:7 piece 27:10 pieces 171:12 pillar 21:18,18 136:9,9 pittsburgh 9:22 30:20 31:3 place 49:18 62:7 120:2 145:22 157:25 166:24 174:12 185:16,17 194:7 placed 44:17 62:9 116:24 156:21 181:8 194:9 planned 136:21 plants 33:9 plastic 96:6 159:20 plate 27:9 platens 186:3 platform 5:11,12 please 5:21 6:7 47:9 74:16 76:20 114:8 128:24 141:9 185:21 plus 19:15 121:1 172:9,9 190:19 pohang 31:4,5,12 33:6	point 25:22,23 40:13 71:24 82:1 83:18 102:1 103:11,14 148:16 148:24 170:20 pointed 88:16 101:12 117:25 pointing 88:22 points 107:14 polished 95:21 96:1 polishing 96:2,9 pool 70:24 71:3,15 71:17 pop 49:23 portion 50:1 51:5 60:24 162:16 portions 1:11 posco 1:5 2:5,13 5:8,23 7:8 31:18 31:22,23,24 32:1 32:10,14,25 33:2,6 52:5 53:5,13 56:4 56:9 57:11 58:9 135:11 187:2 position 31:9 84:15 90:18 161:16 169:11 possibilities 100:2 possible 92:3 123:19 187:9 190:13 possibly 137:2 147:19,21 post 164:20 postech 31:15,17 32:23,25 potential 93:24 practice 96:4 preamble 125:16 125:18,19 126:2	126:15,25 127:8 127:15,23 160:19 160:20 161:17 precipitation 16:21 precise 78:10 79:13 precisely 171:13 precoat 119:15 136:3 precoated 73:9 116:10 135:22 140:6 143:9 164:19 170:14 precoating 72:22 72:23 73:3 81:8 81:25 82:3 116:25 118:10 163:14 164:10,17,23 165:2,4 precoats 165:24 predecessor 146:17 predecessors 9:24 9:25 predictable 36:16 37:7 preferably 81:8 preferred 65:11 67:8 81:4 97:10 101:4 168:5 preform 171:14 premise 153:18,18 153:24 preponderance 34:18,25 35:3 prescribed 84:11 present 71:19,23 presentation 57:4 57:9
---	---	--	--

[press - question]

press 57:15,16,25 59:8 136:5 138:14 181:5,9,14 184:8 presses 27:12 175:5 pressure 36:14 182:10 presumably 101:25 147:17 161:5 presume 113:16 145:5 pretreatment 141:23 pretreatments 141:24 pretty 45:11 71:24 95:25,25 101:25 171:19 prevent 7:20 previous 128:7 previously 4:9 55:9 66:2 prior 22:1,15 23:20 24:1 25:11 30:5 47:6,13 62:9 77:20,24,25 78:9 78:20 84:4 106:17 157:25 194:9 probably 7:4 10:4 15:1 18:12 99:24 105:2,10 146:16 172:6 175:18 188:13 problem 36:15 65:23 165:11 169:18 174:22 proceeding 5:21 8:11 9:8,11,14 31:25 76:18,24 77:25 78:1 114:21	proceedings 42:2 42:2 62:6,8,10 77:5 194:6,8,10 process 12:7 13:3 13:9,15 20:6,12,15 20:18 25:23 46:9 46:12,13,16,23 47:21,24 48:10,13 48:24 58:11 59:3 59:10 66:11,19 68:4 69:2,4,4,8,11 69:14,20,22 119:10,12 130:7 130:11 134:21 142:20,21,22,23 143:8,11 144:6 165:6 171:25 173:3 179:24 180:10 185:10 187:8 processes 24:1 172:14 processing 12:16 15:15 produce 84:7 produced 94:18 product 7:3 14:23 20:19 30:9 36:7 36:25 48:18,20 58:18 66:23,23,24 67:2,5 69:12 88:19 93:23 102:20 116:9,10 125:8 126:10,11 127:1,21 128:12 128:13,22,25 129:6,15 130:11 130:22 141:1 160:9,21,25 161:4 161:7,17 162:2,15 162:16 163:2	171:9 177:25 180:4 187:23,25 188:21 189:6,14 190:23 products 17:22 35:14 36:4,6 42:24,25 43:4 58:15,16 130:4 professor 30:17,19 30:20 31:1,4 32:22 program 186:9 187:1 programs 32:6,9 project 10:6 32:18 32:18 projects 32:19 33:4 pronounce 6:15 proof 165:14,18 proper 43:24 77:9 properties 11:9 19:4 43:23 71:10 123:16 134:20 138:22 140:2,4,11 140:19,25 178:8 179:4 property 177:2 proposal 57:10,12 prosecution 10:22 40:14 41:10 49:10 protection 34:2,4 protective 49:18 prove 165:16 provide 173:20 176:6 provided 42:15 83:23 111:12 provides 50:13 providing 106:13	publication 131:20 pull 49:24 pulling 50:3 pure 102:9 purposes 127:3 pursue 36:19 37:2 push 89:23 186:4 put 43:24 44:15,19 56:10 96:8 115:13 115:14 135:25 141:2,24 171:8 180:3 186:2 188:20 putting 48:5
q			
quality 148:2,9,9 quench 29:15,16 29:17,18,22,22 44:24 46:4,14 48:21 142:3 175:10 181:25 quenched 21:19 23:17 28:22 29:19 30:6 44:1 47:2 136:11 137:19 139:9 171:1 172:4 172:10,12 187:6 189:12 quenches 44:21 quenching 28:21 29:3,6,8,13 30:6 43:9,11,19 44:7,12 47:12 48:7,12 49:1 69:14 130:5 130:13,18 137:15 138:17 140:24 182:4 question 19:24 20:16 23:25 24:18 41:9 47:4 48:23			

[question - relatively]

59:11 71:13 74:16 75:13 101:10,14 102:19 112:7 117:22,23 118:21 141:9 161:14 166:7 173:24 174:16 178:21 190:12 questioning 79:24 questions 7:17 8:1 42:8,18 167:19 179:10 quickly 182:13 quite 134:15 142:16 190:18 quote 26:8 quoted 78:23 quotes 126:25 127:2 134:20,23 188:20	166:10,13 168:9 rapid 64:12 rate 24:2 25:5,24 26:11,18,19,23,25 27:4,19 73:8,12,17 73:25 74:5,9,12,20 74:25 75:17,21,22 76:1,6,7,13,16,22 77:9,13,19 78:1,2 78:17,19,21 83:20 130:20 157:22 158:1 163:17 166:10 176:14,15 181:4,4 186:7 rates 23:19 24:12 24:13,15 25:11,16 25:19,22 26:8,13 166:18 185:8 186:14,15 reach 23:1 50:24 reached 158:4 reaction 45:3 83:6 135:14 136:2,12 139:7 140:7 read 28:16 29:7 30:13 45:21 61:3 94:24 109:5 111:18 123:14 132:24 133:9 147:7 169:20 193:3 reading 39:9 118:25 141:10 real 79:10 150:12 156:7 186:23 187:9 realistic 99:25 realize 147:14 really 46:16 70:25 130:2,3 136:17 148:4 159:25	165:9,10 174:14 175:9 182:12,13 186:22 reason 154:13 183:9 reasonable 36:17 37:1,8 reasoning 38:16 39:18,21 reasons 112:10 113:25 recall 60:14 recap 163:7 receive 10:9 32:13 32:14 recess 40:5 80:8 124:8 169:3 179:19 191:13 recipe 177:11 recited 128:23 129:1,7 130:23 recites 160:8 recognize 56:13 56:14,20 57:4 63:20 133:5 151:15 157:1 record 5:5,20 23:23 40:4,7 50:7 62:10 80:7,10 100:18,19,21 124:7,10 169:2,5 179:18,21 191:12 191:15 192:1,3 194:10 recorded 5:6 redefine 26:19 redefined 26:8,17 26:22 redirect 191:6,16 refer 8:4,7,14,19 132:5	reference 133:7 138:19 156:25 169:8 172:17 181:11 183:16 references 77:24 132:9 referred 157:3 referring 64:3 82:21 97:13 102:12 113:11 131:23 refers 20:11 refinement 16:21 17:6 139:12 refining 16:14 reflect 27:18 refresh 7:6 regard 10:9 region 19:3 regretting 24:7 regular 154:16 172:20 reheat 46:3 181:19 reheated 43:24 172:9 reheating 43:10 44:11 45:6 47:12 181:23 rejects 170:23 related 5:16 40:18 40:21,25 41:1 57:12 116:6 118:7 139:6 relation 119:18 relationship 16:9 16:10 32:1,3 118:6,22 relative 62:15 194:15 relatively 18:4,9
r			
r 6:1 11:10 82:20 131:10 132:25,25 133:1,2,2 141:18 142:12 146:9,9,10 r.o. 31:5 ramifications 41:16 random 101:25 randomly 101:25 range 12:5 15:14 25:25 26:12 40:17 45:22 78:10,24 79:14 83:23 84:12 84:13,14 98:11 99:2 166:13,14,18 186:13,14 ranges 81:12 82:4 97:15,18,22 98:22 100:1,4 101:7,10 102:13,16,24			

relevance 75:22 75:25 relied 76:17,23 77:4 relying 152:4 remained 157:22 remaining 88:2 remember 40:14 96:25 98:21 137:22 173:23 174:23 remind 79:24 80:4 remotely 5:11,18 6:10 removed 44:17 172:1 repeat 20:16 47:9 67:7 70:9 72:16 74:16 75:13 76:20 80:14 89:9 99:12 112:7 114:8 121:22 128:24 141:9 replaced 120:1 replication 100:9 reported 1:19 52:19 reporter 2:16 5:15 6:5,6 50:6,10,13 53:16 60:21 62:4 70:7,10 100:14 192:1 194:4 reporter's 50:9 represent 6:3 representing 7:7 9:10 reproduce 136:21 reproduced 147:25 require 26:6 68:23 74:11,20 77:13	152:16 required 12:9,10 114:1 167:4 requirement 162:24 requires 103:19 reread 148:23 research 9:18,20 9:21 10:6,10,16 32:6,8 33:4,6 91:7 91:9,11,14 133:16 134:3,5 146:5 resistance 11:12 14:14 165:21 resistant 85:5 respect 122:4 response 89:9 responsibility 164:7 rest 86:21 98:8 126:9 132:21 restate 19:21 47:4 result 77:8 results 13:22 85:5 141:16 retained 192:6 retired 15:23 return 169:7 reversible 178:23 revert 91:5 review 7:8 reviewed 148:18 149:1,5,14 reynaert 133:2,22 rich 72:1,4,11 85:23 86:3,12,18 87:24 88:2,7,17 89:2,11,19 90:5,6 94:16 107:20 right 6:19 9:10 10:19 15:4,4 16:2	19:18 20:7,12 21:23 22:7,12,18 22:25 23:6,7,17 29:4 30:25 33:8 34:12 36:8 37:10 37:25 38:9,11 39:10,13,19 40:2 44:4,8 48:14 49:2 50:3,15,16,24 56:10 59:12,18 63:17 64:18,23 65:19 66:19 67:12 67:19 68:4,8,14 69:16,24 70:1,4 73:23 74:8,12 75:2,9 78:11 79:1 79:3,14 82:8,9,9 82:11 83:20 84:17 88:17,19 89:2,3,12 89:13 90:9 93:17 93:21 94:9,9 95:5 95:5 96:14 97:12 97:12,12,12 98:10 98:20 99:10,16,21 100:23 101:8 102:5,17 103:22 105:8,20 106:5,11 107:9,16,23 108:1 108:9,20 109:12 109:22,23 110:19 111:25 112:6,14 112:21 113:13,20 115:14,18 116:10 116:16,25 120:3 121:14 123:3,6,11 127:16 128:3 130:5,9,13 131:5 132:10,18 134:15 135:22 136:5 138:14 140:5,7,8 141:1,14 142:6,6	143:25 144:3,16 144:17,23,25 145:9,14 146:1,14 146:17 147:12 148:11 151:1,22 154:22 155:10,13 156:11 157:6 158:20 159:16 160:17 161:18 162:23 163:3 166:14,15,16,16 166:16 168:18 171:13,21 172:18 172:24 173:13 175:7,12,22 176:16,20,25 177:21 178:2,14 179:4 180:11 187:2,9,13 189:20 ring 49:22 road 3:9 54:9 robot's 180:14 robots 172:1 role 177:7 roll 171:16 177:4 rolled 43:7 59:21 135:23,24 146:24 171:8,8 177:7 rollers 63:11 rolling 177:4 room 12:11 14:22 43:22 64:6,7 129:13 130:15 142:4 159:14 170:22 171:2 172:6 187:5 round 30:22 124:18 180:1 rules 7:4 run 122:25 175:9
--	---	--	---

[s - sentence]

s	137:16 138:21 139:25 140:10 141:12,15,17 143:7 145:1,15 146:1,8 157:18 160:7,23 161:24 168:1,4 175:25 181:1 187:22 188:21	second 8:17,19,25 9:7 11:3,16 14:11 26:1 35:8 42:21 44:10 50:4,16 70:13 71:3,6 72:12 73:18 75:1 77:14,20 78:3 84:21 103:13 110:20 114:15 124:23 131:17 134:9 138:20 139:7 152:22 153:15 157:11 159:15 172:11 186:15,16 187:21 192:2	111:15,21 112:11 113:8 117:21 123:15 124:18 125:2,4,5,10 126:14 127:5 128:5 132:7,21 133:3 134:24 136:5 137:16 139:1,23 141:8,19 146:25 147:6,15 148:6,21 149:7,9 149:16 151:10,24 152:2,14 153:13 154:11 155:6,7 156:3 157:11,15 158:7,17,22,24 159:5,16 160:13 164:21 165:3 168:14 170:14 173:10,10,22,23 175:16 176:19 177:3 179:12 180:17 186:19 188:2
sae 82:23	scale 145:7,8	seconds 45:22	seen 162:10,11 163:24
safe 133:20 134:3 191:19	scanned 122:2	secret 175:6	selective 12:19
sample 88:14 95:7 96:2 145:24 181:20 186:6,9,13	scanning 94:18 95:3 122:1,7	section 34:9 47:20 91:25 93:21,24 94:7 134:17 136:7 161:6 162:3,4	sem 96:18 121:8 121:10 123:1 148:3
samples 187:3	scattered 96:15 121:11 148:2	sectional 91:25	seminars 31:10
saturated 188:18	school 31:11	sectioned 171:10	semisolid 174:10
saw 58:18 108:10 144:15,16 186:14	schools 30:16	sections 144:15	send 50:16
saying 24:24 46:22 48:2 69:7 73:2 75:17 98:24 99:24 102:3 111:3 113:17,19 115:1 118:12 120:18,18 122:16,18 125:7 148:10 152:8 155:8 160:15 161:2 165:3,17,17 169:23 172:13 177:14 185:15 189:16 190:9	science 31:4,12	see 11:2,14 15:19 17:25 21:10 28:25 29:7 31:6 34:19 34:21 35:16 36:21 38:23 43:1,12 56:3,4,5,14 59:23 63:5,12,25 64:13 65:16 70:16 71:5 71:20 72:14,18,21 74:9 81:16 82:18 83:14 84:8,23 85:17,22 86:1,22 87:21,25 88:5 93:4 94:15,22,23 96:13 97:9 101:3 110:3,24,25	sending 50:23
says 11:3 13:23 17:19 35:11 36:2 43:3 57:17 63:5 63:25 64:10 66:14 71:3 81:3 84:1 94:24 101:1,2,3,3 104:11,11 105:15 111:18,19 112:17 113:5 117:12 118:25 119:1,11 119:25 126:23 132:1 133:15 134:16 137:9,15	scope 24:6 29:11 33:18,22 34:11 47:22 57:6,19 58:4,13,22 59:14 60:3 75:19 76:8 117:5 118:3,14 125:14,20 126:3 126:12 127:9 128:17 130:25 153:9 154:8 162:5 162:17 166:4 167:10 177:16 178:3,10,19 180:5 182:6,19 183:13 183:19 184:14 185:23 187:10 188:9,24 189:9,21 190:1,15,24		sense 24:14 25:10 25:18 130:2,3 138:6,8
	scopes 33:18		sent 32:4 57:10
	screen 49:25 50:4 50:18 56:3,6		sentence 11:3 13:23 14:11 17:19 21:5,6 42:23
	searching 152:13		

[sentence - specified]

65:24 66:25 71:9 71:10,18 82:16 113:5 132:1 134:9 169:21 180:23 181:1 separate 46:8 138:16 181:19 separated 155:11 separately 1:25 series 96:8 109:20 set 62:7 194:7 sets 126:6 setup 155:25 183:11 severe 29:15 shade 121:16 shades 123:2,17 148:13 shading 154:15 shape 11:25 43:21 44:20 136:6 139:11 170:21 171:2 share 50:17 51:1 sharing 51:2 60:16 60:17 sheet 27:19 43:21 45:10 59:21 73:9 81:6,20,23 96:8 136:6 185:1 187:6 sheets 26:2 43:7 70:23 176:4 shiny 96:10,12 shoots 121:13 short 17:20 175:24 shorthand 2:16 31:14 53:16 62:3 62:11 194:3,11 show 49:25 76:13 94:12 116:4 122:17 123:12,15	138:4 148:20 152:19 showed 121:18 149:6 174:6 showing 56:24,25 60:18 161:7 176:10 shown 84:4 91:8 111:10 137:25 162:2 176:14 shows 122:20 135:21 147:1 149:24 150:6 176:1 sic 33:18 134:22 side 90:9 146:1 159:16 170:13 sides 82:1 signature 62:23 194:23 significant 157:20 significantly 158:2 silent 83:10 silicon 98:7 similar 35:13,20 35:23 36:3,5,5 144:16 152:23 153:16 181:17 simulate 57:25 184:10 186:20 187:7,8 simulation 184:2 186:16 simulations 182:9 simulator 183:25 simultaneously 112:13 single 116:13,14 137:6 sit 150:4 165:18	site 146:23 size 13:19 16:8 144:8 171:14 186:1 skill 36:18 37:2,6 38:19 39:1,5 47:13 48:24 66:4 74:10,19 75:8 92:16 105:17 106:7,14,16,24 107:5 109:6 136:20 153:4 156:18 181:2 slash 145:16,19,21 145:22,22 slide 57:1,2 slides 58:19,25 59:16 slightly 145:6 small 29:19 93:21 96:5 144:1 158:22 175:19 smaller 17:7 smearing 174:12 smidge 171:23 soaking 137:13 softer 17:11 18:16 solid 17:1 108:15 120:25 121:1 186:1 188:19 solidified 71:17 sollac 146:2,4,4,5 146:16 solution 17:1 108:15 120:25 121:1 188:19 solutions 17:1 36:16 37:7 solve 36:14 somani 156:24 157:4 158:9	159:23 181:10,16 182:1,16,18 185:8 185:25 190:17 somani's 181:21 183:11 somewhat 94:10 sophisticated 18:16 175:9 sorry 5:11 19:21 20:16 35:25 42:23 45:15 48:2 72:16 80:14 86:7 89:9 90:15 91:10 97:25 100:14 104:8,20 112:7 114:14 117:22 121:22 124:24 127:19 132:14 146:21 151:6 155:17 159:17 169:15 182:17 sort 28:8 29:25 31:19 169:18 177:12 179:3,11 179:24 184:23 sounds 182:16 space 145:16 speak 40:9 79:11 80:12,15,21 speaking 191:18 species 165:1 specific 17:21 23:19 77:13 101:13 specifically 72:3 100:25 104:13 105:15 122:4 specification 104:14 specified 73:8 135:16
---	--	--	--

[specimen - steels]

specimen 96:5 158:16 172:4 spectrum 18:5 speculate 127:12 speculating 95:19 146:5 speculation 18:17 24:5,17 28:2 38:2 45:20 48:16 66:21 68:6 81:22 92:7 92:22 94:3 95:9 102:10 105:22 108:14 109:8 112:23 128:17 129:9 130:25 134:1,7 136:16 138:2 142:14 146:19 158:14 184:15 speed 29:24,24 spend 75:16 spending 9:2 spoke 169:21 spoken 133:13 spot 70:19,19,21 72:19 85:5 sprays 182:10 spread 115:5,8,11 115:16,17,21 116:3,5,25 sprouting 147:16 squeeze 186:9 stage 143:22,22 stamp 27:12,12,23 46:4,14 68:20 172:3 175:10 180:3 stamped 20:19,20 20:23 21:8,12,18 21:20,21,25 22:10 22:14,18,20 23:5	23:10,25 25:12 30:4,9 44:20 45:18 47:6 58:15 58:18 65:22 66:23 67:16 69:13 72:5 102:20 125:8 126:11 127:1,21 127:22 128:1,3,12 143:1,2 160:9,21 160:25 161:4,6,17 162:2,15,16 163:2 172:11,12 173:20 174:8 187:3,23 stamper 25:2,5 stampers 24:22 stamping 20:12,15 20:18 24:21 25:12 27:5,13,17 28:5 29:5 43:10 44:11 45:7 46:9,12,18 47:18,24 48:3,4,6 48:12,13,24 56:25 58:11 59:10,17,18 60:6 64:22 65:4 65:14 66:5,11,13 66:14,19 67:11,18 68:4,19,23 69:2,4 69:7,13,16,22,23 85:1 126:16 128:22,25 129:6 129:14,21,23 130:5,7,17,18,21 131:8 140:22 141:25 142:2,11 142:18 156:7,10 164:11,20 171:13 173:8,24 174:1,9 174:17,20,25 175:5 179:24 180:4 181:5,9,14 184:8,11 185:2	186:17,21,23 187:8 stand 156:8 standard 96:4 standpoint 156:19 start 11:16,22 22:8 26:9 42:20 45:2 69:11 86:15 103:17 110:6 164:18,23 166:24 170:13 171:10 181:22 185:25 188:7 started 18:10 37:24 38:4 164:9 starting 48:18 97:8 131:16 139:5 149:8,17 151:19 170:20 starts 30:23 35:9 42:7,24 64:1 82:16 111:19 125:7 157:12 state 5:19,21 61:9 62:4 193:9 194:4 statement 156:8 156:14 statements 33:25 34:3 states 1:1 2:1 5:9 42:3,4 52:1 53:1 134:19 statistical 162:11 stay 89:22 123:22 147:13 155:5 177:13 191:19 stayed 17:1 stays 166:18 steel 9:23 10:1 11:12 12:9,10,11 12:14 14:14 15:17	16:17 17:8,11 18:14,25,25 19:9 19:13 24:1 25:1,2 25:4,6,25 27:9,9 27:11,19,24 28:13 28:14,21 29:14,18 37:16 41:4,17 42:24,25 43:4,23 44:21 46:13,14 47:6,18 57:14 59:21 65:5,22 69:21 72:24 73:4 84:25 86:2 90:3 90:22 91:17,19 92:4,11,18 94:12 115:6,9,22 116:7 116:15,25 119:15 125:8 126:11 127:1,21 128:12 128:13 129:25 130:1 133:18 135:2,2,4,4,6 136:3 139:16 140:6,8 147:17 155:24 159:12 160:9,21,25 161:4 161:7,17 162:2 163:2,14 170:14 170:15,24 171:2,8 171:15 172:4 174:1,2,9,9,24 175:4,8 182:11,13 185:9,10 187:23 188:14 189:2 steels 16:7 17:23 18:2,4,6,9,13,16 18:19,21,23 21:9 21:12,21,22 22:1 22:11,12,14,15,17 22:20 24:3,3 25:12 30:5 38:7
--	--	--	---

[steels - teaching]

41:1 72:20 92:19 146:23 171:10 stein 3:7 5:24 50:3 50:8,15,20,23 54:7 56:3,18 step 11:21 33:1 46:16 58:2,2,3 143:14 steps 12:7 13:3,9 13:12,16 96:9 186:16 stipulated 26:12 stop 60:16,17 stops 171:25 strain 11:25 131:8 138:11 158:22,23 158:24,25 159:2,5 159:11,13,18,20 159:24,24 strains 184:21,22 184:23 street 3:18 54:18 strength 17:23 18:2 23:2 37:18 43:5,23 159:11,14 159:22 191:2 strengthen 16:17 strengthening 15:16 16:3,4,6,6,9 16:23 17:2 striation 147:6 strip 44:14 stronger 17:7 38:8 structure 13:1,1 16:22 19:3,16 83:13 84:7 85:11 98:24 115:2 119:22 127:22,25 139:13 173:21,25 174:2 176:16 185:9 188:1,8,12	188:14,17,22 189:17 190:8,22 structures 12:19 19:10,18 120:20 120:24 190:18 student 92:17 students 10:16 31:11 32:4 studied 15:2 136:18 study 56:4 59:7 79:6 95:14 sub 44:25 subject 7:12 sublayers 113:7 113:13 submitted 8:10 9:8 148:17,25 subranges 81:12 168:10 subscribed 62:18 194:18 substrate 21:15 63:9 84:25 86:2 91:17 94:12 116:7 174:1,2 substrates 91:19 succession 85:3 super 188:18 superficial 72:8,14 72:19 94:17 98:9 98:19 99:2,9,15 100:5 101:11,18 102:15,21,22 104:20,23 108:2,2 109:21 support 9:18,20 9:22 supported 31:23 32:6,8 157:21	supporting 10:16 sure 6:18 18:12,12 27:8 30:12 31:16 31:23 74:18 82:24 86:14 87:4 124:1 125:22 143:16 144:5,9 165:20 167:20 176:11 178:23 185:21 191:9 surface 11:13 14:14,16,18,19,20 14:24,24 88:19 89:2,12 90:7 95:21 96:10,12 108:3 109:22 121:13 136:3 174:10 surprised 116:3 surrounded 181:18 suspend 153:25 suspension 15:11 swear 6:5,7 switch 131:15 173:13 synonym 139:4 system 135:22	40:1 44:14,18 45:17 48:20 66:6 80:2 123:4,7,20 144:6 155:23 156:1,20 168:20 171:7 180:2 185:16 186:2 taken 2:13 5:7 6:21 53:13 59:7 62:6 95:6,20 145:4 161:16 194:6 takes 38:17 talk 8:3 20:10 44:10 60:10 64:22 90:16 104:18 128:19 talking 13:10 16:5 42:11 64:17 65:4 65:18 67:12 77:8 82:24 88:12 89:24 90:17 93:5 100:24 100:25 101:12 105:20 109:24 117:23 118:18,18 131:19 135:3 143:1 151:16 158:19 164:25 181:10 talks 30:25 71:19 76:5 94:23 101:1 102:13 117:25 118:9 138:19 139:21 141:7 tank 170:19 taught 16:1 21:7 30:17 182:24 teach 15:13 183:2 teaches 73:7 teaching 15:21,23
		t	
		t 6:1 11:6,6,10,10 11:11 16:10 82:20 82:20 91:23,23 131:10 132:25,25 132:25 133:1,2 141:18,18 table 65:3 140:3 140:20 tackle 26:9 tailored 17:21 take 7:23,24 8:1 9:3 11:21 32:25	

[technical - three]

technical 36:20 technique 35:12 35:23 36:7 96:17 123:8 techniques 35:19 technology 31:5 31:13,18 39:6 tell 7:17 11:23 18:10 44:12 63:19 70:18 75:25 85:19 87:2,5,9 94:21 95:15 105:7 108:11 112:10 119:1 121:16 122:1,22 124:21 148:12 149:12 150:4 152:5,6 165:9 167:2,7 176:9 183:17 telling 127:16 142:24 tells 87:10 122:7 126:10 143:10 167:3 temperature 12:2 12:3,10,11,12,20 12:24 13:21 14:23 16:24 20:7,20,23 20:25 21:17 22:22 23:4 24:4 27:7,10 43:22,25,25 44:7 44:16,22,25 45:1,4 45:8,24 46:13 48:11 58:2 64:6,7 64:8 65:23 83:22 84:13,14 129:13 129:16 130:15 137:5,13 138:8,12 142:4 143:17 158:3 159:14 160:1 163:18	166:10 170:22 171:2 172:6 173:7 173:7 176:2,24 180:9 187:5 189:3 189:13 temperatures 13:7 19:19 20:5 137:3 137:4 ten 136:14,23 144:7 tend 18:5 term 42:24 68:1 103:18 104:3 106:2,5 116:5 137:20 139:3 142:25 147:14 terminology 28:25 40:23 60:5 terms 41:15 104:24 106:21,25 107:1,6 170:3 test 141:15,15,17 testified 6:11 testifying 7:10,13 7:21 62:9 194:9 testimony 7:11 25:14 61:6 77:16 80:5 124:13 192:4 193:6 tests 146:15 tetragonal 19:16 text 105:13 textbook 105:14 texture 17:3,4 thank 8:2 80:24 88:10 124:5 140:16 173:12 185:7 186:25 191:3,17,20 thanks 191:10,22 191:22,23	therebetween 81:12 168:10 thereof 62:13 194:13 thermal 59:15,21 59:25 60:6 117:13 117:18 118:11 119:3,11 158:4,10 182:12 thermodynamic 164:25 thermomechanical 12:15 16:19 20:2 137:21,24 138:4,9 138:13 thesis 175:13 thick 163:16 168:17,18 thicker 176:20 thickness 81:7,9 82:3,8,11 135:25 160:11,16,24 161:1,25 162:12 162:21 163:12,13 163:20 164:10,11 164:17,19,23,24 165:4,5,20 166:2 166:11,19 168:6 176:4 thicknesses 164:20 thin 45:10 thing 31:19 59:25 70:24 71:25 82:25 113:12 118:2 165:19 176:13 187:9 things 24:23 88:22 107:16 109:11 174:15 178:23 191:21	think 17:12 20:11 22:16 24:11 28:16 28:20 29:24 31:15 32:24 33:3 34:7 34:24 38:3,3 49:4 57:10 66:9,9 67:25 68:2 70:25 71:1,16 87:10 88:6 91:13 92:11 94:5,24 96:24,24 101:21 105:2,23 106:2 107:4,4 113:11 115:23 116:5 120:22 128:10 135:19 146:4,5,22 148:16 148:24 149:20,20 150:10,10 163:15 164:13,22 165:10 165:10,15 166:6 166:17 169:10,22 174:18 179:9 183:7,7 184:16 190:3 thinking 7:21 thinner 37:18 38:8 165:24 176:20 177:10 third 24:22,24 25:5 35:9,12 42:23 71:7,7 82:16 86:10,21,22 88:4,13 96:20 150:10,15,24 151:7,9,14,16 152:10 175:3 thought 180:10 three 6:24 10:11 41:17 46:12,16 85:25 86:8,9 153:13 154:11,13
---	--	---	--

155:7 156:1,5,10 156:23 178:16 184:25 185:3 thursday 1:14 2:14 5:1 52:14 53:14 time 5:21 10:4 18:5 22:9 26:9 38:19 39:1 40:3,6 45:18,24 58:8 62:7 64:5,6 69:11 75:16 77:7 80:6,9 83:22 84:5 100:17 100:20 105:17 106:24 117:13 119:3,11 124:6,9 124:17 137:13 144:21 155:23 156:9,20 169:1,4 174:3 175:11 176:3,24 179:17 179:20 180:10,15 184:18 186:6 189:2 191:11,14 194:7 times 6:23,24 32:5 147:24 163:19 title 32:24 56:14 today 7:11,21 8:18 40:12 150:4 165:18 today's 192:4 told 40:12 75:18 75:20 105:18 112:8 120:13,17 122:4 155:7 tone 152:9 tool 29:18 top 30:25 88:6,6 88:13 90:7,24 101:15,24 144:11	144:14,21,23,25 145:20 146:25 147:10 149:8,18 150:7,18 151:11 151:12,17,19 177:19,20 topic 173:15 topics 15:14 17:20 total 165:20 176:3 176:4 192:5 tp 81:7 trademark 1:1 2:1 5:10 52:1 53:1 traditionally 69:15 transcribed 62:11 194:11 transcript 1:11 49:11 50:1 51:5 52:11 60:24 61:4 191:25 193:4 transcription 62:13 194:13 transfer 171:24 181:24 transferred 136:4 172:2,12 181:20 185:10 transformation 11:6,17 12:22 13:4,7,17,19 16:24 189:14 transformed 19:19 117:15 119:5 transforming 118:9 transforms 12:25 translation 146:12 146:13	transmission 15:10 transmissions 15:11 trapezoid 177:9 177:20 178:2 trapezoids 176:19 177:14 179:2 traveling 63:11 treated 58:15 66:24 172:8,9 173:18 187:4 treatment 12:13 14:25 16:12,19 20:2,3,4,6,9,14,17 20:24 21:2,4 44:2 44:6 46:5,8,17,23 46:24 47:2,5,14,20 48:4,9,14 49:1,6 57:16,17,22,24 58:1 59:12,17,22 59:25 60:1,6,8,11 60:13 63:25 64:4 64:20 65:5,13 66:5,14,16,18 67:10,12,13,19,21 68:4,11,15,19,20 69:1,15,24 70:4 85:1 117:14,18 118:11 119:4,12 130:19 137:21,24 138:5,9,13,24 139:3,6,10 140:1 142:12,19,22 143:1,18,21,24 169:11,22,24 172:14,21,25 173:2,3 treatments 11:13 14:15,16,19,20 16:16 20:11 58:10	58:11 63:6 64:23 65:18 67:22 trial 1:2 2:2 52:2 53:2 175:10 tried 136:22 true 23:2 61:7 99:25 165:10 193:7 trust 149:24 150:2 truth 152:5 truthfully 7:21 try 29:16 123:9 187:8 trying 47:11 48:18 71:14 75:21 82:2 121:24 122:3 162:25 185:14 187:7 tth 145:16,20,23 tunnels 28:12 turn 8:25 10:24 12:21 15:5 42:6 47:3 80:25 85:14 124:16,17 135:7 187:15 turnaround 191:25 turned 72:22,23 73:3 172:3 turning 24:8 turns 116:15 two 8:10 13:11 18:25 19:17 33:8 33:9 58:18,25 59:16 70:23 86:19 88:22 89:1,11,18 91:20 107:13,13 107:15 109:11,12 109:16,18 113:3,7 113:13 115:15 120:19,19,20,21
---	---	---	---

120:21 134:14 136:5 144:7 149:25 154:13,15 154:22 155:8 156:23 172:13 174:24 176:19 178:18 185:1,2,5 186:3 type 26:1 96:18 types 17:21 typical 25:10 29:18 45:24 140:2 140:13 156:9,19 typically 25:4 156:10 180:9	121:24 122:12 125:24 126:1 155:4 156:19 161:13 169:10 170:4 173:12 186:25 191:5 understanding 25:8 26:23 31:20 33:17 42:14 86:14 122:6 125:19 128:14 130:12 161:9 183:11 189:24 understood 181:3 undescribed 85:24 unit 5:6 united 1:1 2:1 5:9 42:3,4 52:1 53:1 units 192:6 universe 127:20 universities 175:17 university 9:21 10:8 30:19 31:3,4 31:12,13,21 32:14 39:12 182:24 183:2 unpatentability 34:17 unpatentable 34:23 unquote 26:8 use 16:16 18:23 23:21 35:12,19 39:18 49:16 60:5 60:13 66:3,4 67:23,24 68:1,10 68:19 69:23 70:3 87:6 98:11 116:5 123:8,8 138:22 142:25 152:22	user 25:3 uses 25:6 172:25 usibor 134:19 135:1,2,23 142:12 143:9 170:14 usinor 133:15 134:5,22 140:12 146:6 usually 24:21 44:24 uts 43:5 171:3	viewed 60:7 virtually 7:10 visited 32:5 visiting 30:20 184:20 voltage 94:24,25 95:1 volume 1:15 2:13 4:4 24:8 45:5 52:15 53:13 55:4 107:20 119:21 vs 1:7 2:7 52:7 53:7
u		v	
u 11:6 132:25 133:1,1 142:12 145:15 183:3,3 u.s. 8:6 uh 87:23 97:4 110:17 114:17 136:8 137:18 139:8 158:21 165:23 170:12 174:11 175:2 177:8,12 undefined 86:20 88:3 89:20 undergoes 140:7 underneath 133:15 146:9 undersigned 62:3 194:3 understand 7:11 7:16 22:10 27:8 38:14 42:9 67:18 71:14 73:2,5 74:11,19 75:8,14 75:21 89:1 90:18 100:3 116:23	understood 181:3 undescribed 85:24 unit 5:6 united 1:1 2:1 5:9 42:3,4 52:1 53:1 units 192:6 universe 127:20 universities 175:17 university 9:21 10:8 30:19 31:3,4 31:12,13,21 32:14 39:12 182:24 183:2 unpatentability 34:17 unpatentable 34:23 unquote 26:8 use 16:16 18:23 23:21 35:12,19 39:18 49:16 60:5 60:13 66:3,4 67:23,24 68:1,10 68:19 69:23 70:3 87:6 98:11 116:5 123:8,8 138:22 142:25 152:22	v 5:8 vaguely 40:25 value 81:14 99:19 99:25 168:11 values 97:6 136:13 136:22 140:13 variables 148:1 variation 94:8 112:25 113:2 163:1 vary 94:1 155:25 vehicle 141:2 verb 115:8 verify 9:7 164:9 veritext 5:14,15 192:6 video 5:6 videoconference 1:13 2:12 52:13 53:12 videographer 3:22 5:4,14 6:6 40:3,6 54:22 80:6,9 100:15,20 124:6,9 168:22 169:1,4 179:17,20 191:11 191:14 192:3 view 25:23,23 28:4 59:15 63:7 78:14	w 33:7 wait 71:6 168:2,2 168:2 180:24 walk 135:17 169:19 want 9:2 34:8 38:7 71:25 75:13 79:24 95:18 100:3 101:16 123:22 130:10 132:21 135:10 139:15 142:16 147:6,15 153:24 155:5 171:2 184:10 185:18 187:8 wanted 118:1 wants 49:16 177:6 water 27:18 28:12 29:14 44:20 47:1 139:9 140:24,24 171:1 172:3,5 183:21 way 24:23 35:14 35:21,24 50:19 68:1 71:16 79:8 91:22,24 114:4 165:18 172:6

[way - zinc]

174:19 175:12,14 ways 79:7 we've 15:2 39:24 56:10 79:22 91:16 120:22 122:19 145:8 weaken 72:2 weaker 18:18 webex 5:12 weight 37:19 weld 70:24 71:3 71:15,17 72:1 176:22 weldability 70:19 165:22 177:11 178:7 welded 142:6 welding 70:20,21 72:19 85:6 176:7 weldment 72:2 went 29:17 178:13 178:16 whereof 62:17 194:17 whichever 101:16 white 18:24 136:10 142:7,7 width 93:2 96:7 window 50:21 wiper 81:25 witness 4:2 6:4,5,7 18:18 22:4 23:13 24:18 25:8,15,21 27:17 28:3,11,20 29:13 30:9 34:7 36:25 37:13,18 38:3 39:4 40:2 45:10,21 46:1,7 47:9,16,24 48:17 49:4 55:2 58:6,14 58:23 59:6,15	60:4 62:17 64:25 65:21 66:9,22 67:4,15 68:18 69:7,18 70:1 72:8 74:15,22 75:5 76:10,20 77:1,7,17 77:22 78:5,14 79:6,17 80:17 81:23 85:10 88:10 89:17 92:8,23 94:4 95:10 96:4 97:21 98:14 99:6 99:12,18 100:8 101:21 102:8 103:2 104:5 105:2 105:23 106:20 107:4 108:15 111:15 112:17,24 113:16 117:7 118:5,15,21 119:14 120:5 121:22 123:19 124:1,4 125:16,22 126:5,14 127:11 128:5,18 129:3,10 129:19 130:7,15 131:1,7 136:17 137:2 142:15 143:21 147:4,19 148:16 149:20 150:2,9 151:4,24 152:21 154:10,24 156:15 158:15 161:13 162:7,19 163:23 164:13 165:9 166:6,23 167:12 168:21,25 169:15 173:6 174:22 176:13 178:5,21 180:7,13 181:16 182:8,21	183:20 184:5,16 185:5,14,25 188:11 189:1,11 190:3,17 191:1,20 194:17 witnesses 62:8 194:8 word 20:1 22:11 29:21 35:9 66:3,4 67:15 68:10,15 69:23 70:3 89:22 106:17 107:8,11 111:23 112:12 114:25 116:3 118:12 145:16 146:9,10 147:13 172:25 173:2 188:23 words 22:10 34:5 34:11 42:24 60:13 66:16 69:18,20 75:18 81:4 108:20 108:21 112:19 114:6,10 181:21 work 9:13,14,14 9:17 10:2,5,10,18 10:22 28:18 32:9 33:2 40:14,16,18 40:24 91:13 152:4 164:14,16 165:19 166:25 181:21,22 185:8 worked 41:3,5 working 14:6 58:9 133:22 works 122:3 world 9:23 71:25 150:12 worried 152:3 worry 152:5	worse 148:9 worth 10:11 wrap 179:11 write 34:8 written 81:14 168:12 wrong 29:1 90:21 100:16 113:12 165:25
x			
x 121:5			
y			
y 33:7 121:6 133:2 yeah 28:3 29:10 45:16 48:17 50:8 75:15 88:23 94:4 98:14 100:15 103:13,16 104:11 105:16,23 120:25 123:11 144:1 145:23,23 146:4 154:10 159:4,19 166:6,23 173:12 179:9,9 184:3,3 185:21 191:7 year 10:12 15:23 18:10 32:18,19,21 years 9:19 10:4,11 13:24 14:3 29:14 32:2 yellow 137:8 yields 85:4 york 3:19,19 54:19,19			
z			
z 146:8 zero 98:7 159:13 zinc 21:16 22:17 41:4 47:18			

[zone - zoom]

zone 146:8

zoom 5:11 56:6

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.