

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANADIAN SOLAR, INC.

Petitioner

v.

MAXEON SOLAR PTE. LTD.,

Patent Owner.

IPR2024-01039 (Patent 8,222,516 B2)

IPR2024-01040 (Patent 8,878,053 B2)

Record of Oral Hearing

Held: October 15, 2025

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and
AVELYN M. ROSS, Administrative Patent Judges.

IPR2024-01039 (Patent 8,222,516 B2)

IPR2024-01040 (Patent 8,878,053 B2)

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The above-entitled matter came on for hearing Wednesday,
October 15, 2025, commencing at 1:06 p.m. MDT, via Videoconference.

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

(1:06 p.m.)

JUDGE KALAN: Good afternoon, everybody, and welcome back. Thanks for your flexibility in reconfiguring this to an all-virtual hearing, as well.

In this afternoon's hearing we'll hear arguments in IPR2024-01039, concerning U.S. Patent Number 8,222,516, and IPR2024-01040, concerning U.S. Patent Number 8,878,053.

I'm Judge Kalan. Joining me are Judges Kokoski and Ross. And I'll start with appearances, beginning with Petitioner.

MS. BOLL: Good afternoon, Your Honors. This is Brooke Boll from Sidley Austin, presenting on behalf of Petitioner, Canadian Solar. Here with me today is Samuel Tiu, also from Sidley Austin.

JUDGE KALAN: Thank you. And for Patent Owner?

MR. SNODGRASS: Good afternoon, Your Honors. My name is Jeremy Snodgrass, and Jing Zhao. We're with the law firm PV Law LLP, and we're representing Patent Owner, Maxeon Solar. I will be presenting.

JUDGE KALAN: Thank you. I'll restate the reminders from this morning that we, the Judges, have a copy of the demonstrative exhibits that were submitted to the Board. During your arguments, please clearly and specifically point to the demonstrative by slide or screen number so we can follow along and so we have clarify in the transcript. Because this is a virtual hearing, we'd like you to keep your line muted when you're not speaking. There may be some audio lags; please consider that and perhaps pause before speaking to avoid speaking over others.

1 In our hearing order, we allowed each party 60 minutes to present
2 arguments. Petitioner will proceed first and may reserve time for rebuttal.

3 Petitioner, how much time would you like to reserve?

4 MS. BOLL: Fifteen minutes, please.

5 JUDGE KALAN: Thank you. So you'll have 45 minutes for your
6 case-in-chief.

7 And, Patent Owner, you will then have 60 minutes, as well. Would
8 you like to reserve any time?

9 MR. PETERSON: Fifteen minutes, as well, Your Honor.

10 JUDGE KALAN: Thank you. And, Petitioner, whenever you're
11 ready, you may proceed.

12 MS. BOLL: Thank you, Your Honors. I'll just share my screen.
13 Good afternoon, Your Honors. The institution decision recognized that a
14 person of ordinary skill in the art, or a POSITA, would have a motivation to
15 combine and a reasonable expectation of success in doing so with the
16 combinations of Froitzheim and Gan and Froitzheim and Kwarck to arrive at
17 the challenged claim of the '516 and '053 patents. The evidence that has
18 developed since institution further supports the Board's decision and a
19 finding that all challenged claims are unpatentable. As it did in its
20 Preliminary Response, Patent Owner continues to apply an overly exacting
21 standard on the motivation to combine and reasonable expectation of
22 success, which is not consistent with the law or the weight of the evidence
23 that has developed.

24 Patent Owner's only evidence to combat Petitioner's strong showing
25 is the Gan thesis, which is a thesis. It reports on trial and error of a student
26 who was seeking an advanced degree and which Patent Owner has not

1 shown is the work a person of ordinary skill in the art. The broader and
2 more oratory thesis does not undermine the significance of Gan or the other
3 record evidence to a POSITA.

4 If we turn now to Slide 4 of the demonstrative, which is Exhibit 1088
5 in the 1039 proceeding and Exhibit 1103 in the 1040 proceeding, many of
6 the issues are undisputed at this point. There is no dispute that all elements
7 of all claims are met by Petitioner's prior art references with the exception of
8 one dependent claim of the '516 patent. There is no dispute that the Hartiti
9 or Sivoththaman references are appropriately combined with other
10 references for those grounds in the 1040 proceeding, and there is no dispute
11 that the secondary considerations weigh in favor of a finding of obviousness.

12 On Slide 5, what these IPRs essentially boil down to, motivation
13 combine and reasonable expectation of success. I'll focus mostly on those
14 arguments today in my presentation.

15 JUDGE KALAN: Counsel, before you go forward, on Slide 2, the
16 Meier grounds from the 1039 proceeding are grayed out. Could you for the
17 record clarify what, if anything, you're requesting the Board to do in
18 drafting its final written decision as to these grounds?

19 MS. BOLL: Yes, Your Honor. Petitioner is maintaining Grounds 1
20 and 2 for the argument that collateral estoppel should apply and the claims
21 should be invalidated based on those combinations given that the Patent
22 Office used those combinations to invalidate substantially similar claims. In
23 Petitioner's view, this is really a question for appeal and a legal question as
24 though there's nothing further to clarify on the record beyond what's been
25 submitted in the briefing.

1 Beginning now with Slide 6, the institution decision correctly found a
2 motivation to combine Froitzheim and Gan. As we'll discuss, that
3 motivation is supplied within the prior art references themselves as well as
4 other argument of a POSITA before the priority date. If we look at Slide 7,
5 Petitioner's base reference, Froitzheim, disclosed a 1 sun solar cell with a P-
6 type diffused emitter and a rear-side contact. Froitzheim touted that this
7 rear-side construction showed improved stability and good efficiency, but
8 the POSITA looking to make an efficient solar cell would look to Froitzheim
9 as well as other art, such as Gan, shown in the next slide, Slide 8.

10 Gan proposes a POSITA to combine it with Froitzheim because of the
11 stated improvement that results from replacing the diffused emitter with a
12 polysilicon emitter. Patent Owner's argument in its Response and Surreply
13 focus on the oxide layer, ignoring that there are additional benefits provided
14 by using a polysilicon emitter plus an oxide as compared to a diffused
15 emitter. As shown here, Gan reports that a diffused emitter is associated
16 with a high J_{naught} or a recombination, in particular a 4.5×10^{-13} to the
17 minus 13.

18 Replacing the diffused emitter with a polysilicon emitter improves the
19 J_{naught} such that it would be less than 4.5×10^{-13} of
20 diffused emitter while still maintaining a low enough ρ_{sub-C} or contact
21 resistance. This provides at least part of the motivation for a POSITA to
22 replace Froitzheim's diffused emitter with a polysilicon emitter and
23 interfacial oxide construction of Gan.

24 The other aspect of Gan that would motivate a POSITA to combine it
25 with Froitzheim is the advantages Gan touts from the interfacial thermal
26 oxide. The Gan reference reports data showing the benefits from its

1 polysilicon emitter with interfacial thermal oxide in Table 1 of Gan.
2 Specifically, the resulting J_{naught} is an order of magnitude lower compared
3 to a diffused emitter with no interfacial oxide, and Gan itself called out that
4 the data are quite useful for silicon solar cells given the low J_{naught} and
5 suitable ρC . This provides a motivation to combine with Froitzheim to
6 develop a more efficient solar cell.

7 As you'll see on this slide, at an anneal temperature of 900 degrees for
8 four hours, consistent with Froitzheim's disclosed range, the J_{naught} values
9 are below 5×10^{-14} , which would be advantageous value
10 touted in the paragraph shown on the slide. In particular, for 900 degrees,
11 you get 2.4×10^{-14} for an N-type and 3.5×10^{-14} for a P-type. The ρC is also below the 5×10^{-5}
12 ohms per centimeter squared that is identified as advantageous to the text of
13 Gan. Here we have 1.8×10^{-5} for both N-type and P-type
14 emitters. Thus, a POSITA would understand that these advantages disclosed
15 in Gan are applicable to a solar cell, a 1 sun solar cell as Froitzheim.

17 Gan also discloses that a POSITA still sees significant advantages at
18 1000 degrees. Even at the higher 1000 degree temperature that Patent Owner
19 argues Froitzheim preferred, the J_{naught} was still much lower than the J_{naught}
20 for diffused emitters. Table 1 shows ranges of 4.5×10^{-14} to the
21 minus 14 and 10.5×10^{-14} for polysilicon interfacial oxide
22 that's annealed at 1000 degrees even at the 60-minute higher length of time.

23 This is still much lower, an order of magnitude lower, than the 4.5
24 times 10^{-13} J_{naught} that's reported in Gan for the diffused
25 emitters that we saw on the previous slide, Slide 8. Thus, regardless of
26 whether the anneal temperature is 900, 1000, or somewhere in between, a

1 POSITA would still be motivated to use the interfacial oxide with
2 polysilicon structure.

3 Turning to Slide 10. Patent Owner's Response criticized Gan as being
4 focused on concentrator solar cells rather than 1 sun cells, but Gan does not
5 limit its findings or conclusions to concentrator solar cells, and a POSITA
6 would understand those findings to be more broadly applicable. For
7 example, the Lemiti reference, which is Exhibit 1048 in both proceedings,
8 cites to Gan and describes it as investigating polysilicon emitter solar cells
9 generally. It does not limit its teaching to just concentrator solar cells.

10 Indeed, as we see on the next slide, Slide 11, Patent Owner's expert,
11 Dr. Ruby, agrees it would be worth looking at publications concerning
12 concentrator solar cells when developing a 1 sun cell. Concentrator solar
13 cells actually have more requirements and more specialized methods, so
14 while 1 sun art may not be conclusive on how to develop a concentrator
15 solar cell, what meets the more stringent requirements for a concentrator cell
16 will undoubtedly result in an improved 1-sun cell.

17 Moving to the issue of reasonable expectation of success in combining
18 Froitzheim and Gan, if we turn to Slide 12, the institution decision correctly
19 found that Froitzheim and Gan could have been combined with a reasonable
20 expectation of success. Petitioner's argument is a textbook KSR rationale,
21 substituting one known emitter type, a diffused emitter, for another known
22 emitter type, a polysilicon emitter with an interfacial oxide, to improve a
23 solar cell in the same way to achieve predictable results. In the Patent
24 Owner Response and Surreply, the Patent Owner continued to do what the
25 Board cautioned against, which is applying a requirement of absolute

1 predictability. As recognized in the *In re Longi* case, only a reasonable
2 expectation, not absolute predictability, is required.

3 In the 1040 proceeding, the Board made similar findings, recognizing
4 also under *Pfizer v. Apotex* that obviousness cannot be avoided by simply
5 showing some degree of unpredictability. A reasonable and a reasonable
6 expectation can be found where a reference tells the POSITA how to solve a
7 particular shortcoming.

8 With respect to Patent Owner's only additional reference, the Gan
9 thesis, the Board recognized that it provided oxidation at lower temperatures
10 can allow for more precise control of the growth of the oxide. These
11 techniques were within a POSITA's understanding in 2008, as reflected in
12 testimony from Dr. Banerjee as well as at least the Lemiti and Kermani
13 references, which are Exhibit 1048 and 1063.

14 Patent Owner spends a lot of time in its briefing on the Gan thesis,
15 claiming it shows a person of ordinary skill would have no reasonable
16 expectation of success. A thesis, however, reflects musings, trial and error
17 over a lengthy graduate study, and Patent Owner has not shown that the Gan
18 thesis reflect the work of a person of ordinary skill in the art.

19 If we turn to Slide 14, the parties agree on the definition of a person of
20 ordinary skill in the art. It requires an advanced degree plus two years of
21 experience, or alternatively, a bachelor's degree and three years of
22 experience. Maxeon and Patent Owner apply the same level of skill, so
23 there's no dispute on this, but there is no evidence in the record of whether
24 Gan was a POSITA at the time he conducted the experiments that are
25 reported in this thesis or whether he had completed three years of research to

1 supplement his bachelor's degree. We only know he was in the process of
2 getting an advanced degree at that time.

3 By contrast, Gan itself was published in the industry including an
4 author, Richard Swanson, that was renowned in the industry. Gan itself was
5 cited by others in the industry, such as Lemiti, while we have nothing in the
6 record showing the Gan thesis ever having been cited. Thus, the Gan thesis
7 and Gan do not stand on equal footing with respect to their impact on a
8 POSITA or what they reflect about a POSITA's understanding or reasonable
9 expectation of success. The Gan thesis should be given little or no weight
10 compared to Gan itself.

11 Patent Owner makes much of the purported Froitzheim range being
12 different from or incompatible with Gan. A POSITA would readily
13 reconcile for a time in Gan by conducting doping in a range of 900 to 1000
14 degrees, consistent with both teachings. The Petition explained that the
15 disclosures were consistent and interchangeable. For example, in the 1040
16 proceeding, the Petition at pages 36 to 37 describes that diffusing the dopant
17 from the layer and the diffusion layer into the polysilicon layer, as shown
18 either on steps 9 and 10 of Gan or described in paragraph 40 to 41 of
19 Froitzheim. So the Petition explicitly says these two references are
20 interchangeable and entirely consistent.

21 Furthermore, a person of ordinary skill in the art looking to
22 Froitzheim after incorporating the polysilicon emitter and interfacial oxide
23 of Gan would understand to use the lower end of the Froitzheim range
24 because now you're in a different situation. In Froitzheim, you're dealing
25 with doping monocrystalline silicon, and in Gan, you're doping polysilicon.
26 As Dr. Banerjee explained in his Reply declaration, it was well known in the

1 art that dopant diffusion into polysilicon does not require as high of an
2 anneal temperature. Thus, a POSITA exercising ordinary creativity would
3 simply select the lower end of the Froitzheim range to maximize the benefits
4 to J naught that are disclosed in Gan.

5 Turning to the next slide, Slide 16, Patent Owner argues that the
6 alleged difficulty Gan had in producing a reliable thermal oxide as reported
7 in his thesis shows that a POSITA would not have a reasonable expectation
8 of success. Even taking the Gan thesis as reflective of a person of ordinary
9 skill, which it is not, later developments show that by the time of Froitzheim,
10 thermal oxide growth could be performed reliably, and optimizing that was
11 well understood in the art.

12 As shown in Lemiti, which cites Gan, thin oxide films could be grown
13 in the range of 1000 to 1200 degrees Celsius, and Kermani, which is cited in
14 Lemiti and therefore was known at least as of that time, similarly reports
15 ways to control the thermal oxide growth, including by reducing the
16 oxidation kinetics to allow for more controlled growth. This echoes the
17 precise solution proposed in the Gan thesis. If you lower the temperature,
18 you can control the growth of the oxide better. And this would have been
19 well within the understanding of a POSITA before 2008. Indeed, Dr. Ruby
20 agrees it was known prior to 2008 that lowering the temperature at which an
21 oxide is formed will slow the growth, thus enabling the better control that
22 the Gan thesis provides.

23 Another argument for Patent Owner is that a person of ordinary skill
24 in the art would have no reasonable expectation of success because
25 combining Froitzheim and Gan would result in a suboptimal contact
26 resistivity, but the rho C values reported in Gan were described as

1 suboptimal in the context of a concentrator solar cell of Gan. Petitioner's
2 combination undisputedly is a 1 sun solar cell like Froitzheim. And as
3 Patent Owner's expert, Dr. Ruby, recognized here, concentrator solar cells
4 require a lower resistance than 1 sun solar cells for various reasons,
5 including higher current that concentrator solar cells must be capable of
6 handling. Thus, a contact resistance described in Gan as suboptimal would
7 not be suboptimal for the 1 sun context. Instead, it is adequate as it is far
8 lower than the 5 times 10 to the minus 5 threshold described as
9 advantageous in Gan at page 246.

10 JUDGE KALAN: Just to be clear, and I can look at the references
11 and tie it all together, but when you were referring to Gan, you were talking
12 about the Gan reference on which we instituted and not the Gan thesis unless
13 you're explicitly referencing the Gan thesis; is that correct?

14 MS. BOLL: That's correct. I'll try to say "Gan" when I'm referring
15 to the Gan paper and then "the Gan thesis" or "the thesis" when referring to
16 the thesis, Exhibit 2003.

17 JUDGE KALAN: Following the discussion, the introduction of the
18 Gan thesis, is there anything you're relying on in the thesis, or is it primarily
19 rebutting Patent Owner's arguments concerning what the Gan --

20 MS. BOLL: So we are just responding to Patent Owner's argument in
21 Gan regarding Gan thesis. We are not relying on anything in the Gan thesis.
22 In our Reply, we did acknowledge that there are portions of the Gan thesis
23 that actually support Patent Owner's argument. In particular, the Gan thesis
24 recognizes that the polysilicon emitter is a useful substitute for diffused
25 emitters, including at page roman number IV of the Gan thesis, and this is
26 discussed on pages 7 to 8 of Petitioner's Reply in the 1039 proceeding.

1 So if the Gan thesis is considered, it does actually support Petitioner's
2 arguments, and in addition, as the Board recognized in its institution
3 decision, some of the trial and error that Gan experienced in developing his
4 thesis led him to understand that if you need to better control the growth of
5 your oxide, you simply lower the temperature.

6 JUDGE KALAN: So the reliance on the Gan thesis, if we can call it a
7 reliance, is just illustrative or supportive? I guess I'm looking for -- and I'll
8 ask Patent Owner this as well -- I'm looking for the hook that brings it in
9 and its role within our analysis in the final decision, the grounds on which
10 we will stand.

11 MS. BOLL: Right. So Petitioner's position is that the Gan thesis
12 should be given no weight given the nature of it as a thesis, but if it is
13 considered, it does support Petitioner's positions.

14 Just to briefly touch on teaching away, Patent Owner claims that
15 Froitzheim and Gan teach away from each other, but this is incorrect. Their
16 expert admits the two disclosures are consistent. What's disclosed in
17 Froitzheim is 900 to 1200. 900 to 1000 from Gan is consistent with 900 to
18 1200; it's just the lower end of the range. A preferred range is Froitzheim
19 does not constitute teaching away as a matter of law.

20 Teaching away is a very high bar. For example, in *UCB v. Actavis*,
21 which is that 65 F.4th 679 from 2023, the Federal Circuit affirmed a
22 reference did not teach away from a lower percentage where it nearly
23 expressed a preference for a higher percentage. Similarly here, Froitzheim is
24 not teaching away from 900 to 1000 by saying it preferred 1000 to 1100.
25 And again, a POSITA would naturally select the lower end when doping a
26 polysilicon emitter rather than a diffused emitter.

1 Before I move on to the Kwark combination, are there any other
2 questions on the Froitzheim and Gan combination? Okay.

3 So turning now to the combination of Froitzheim and Quark and
4 beginning again with motivation to combine, the institution decision
5 correctly found that a person of ordinary skill would be motivated to
6 combine Froitzheim and Kwark. As the Board recognized, polysilicon
7 emitters with an interfacial chemical oxide layer showed improved
8 performance over polysilicon emitters without a chemical oxide and even
9 more improved performance as compared to a diffused emitter like
10 Froitzheim.

11 If we turn to Slide 25, Kwark Figure 4 has been the focus of much of
12 the parties' briefing. The caption of the figure provides part of the
13 motivation to combine. It notes out to a POSITA the large difference when
14 the interfacial oxide is missing, and by large difference, it's referring to the
15 large difference in the J_{naught} or the recombination.

16 As explained in the text of Kwark, these results were achieved by
17 growing an interfacial chemical oxide through a process known as RCA
18 cleaning. And so you see the two lines up toward the bottom of the graph
19 corresponding to with chemox, but no chemox slightly above that is the
20 control, and that was created by dipping the wafer into HF. So you dip half
21 the wafer into HF according to Kwark to remove the oxide to generate that
22 half of the wafer that's the control.

23 If we turn to Slide 26, we see more reasons in the disclosures of
24 Kwark that would motivate a POSITA to combine Froitzheim and Kwark.
25 In particular, the polysilicon emitter films, which are the gamma equals zero
26 films, yielded a surprisingly low J_{naught} . And Kwark also noted that

1 incorporating polysilicon emitters translated to improved energy conversion
2 efficiency for solar cells. This provides the motivation to combine.

3 Patent Owner again argued that Kwark and Froitzheim are
4 incompatible because Froitzheim's disclosed anneal temperatures are too
5 high and would result in breakup of the oxide, but this would not be
6 discouraging to a POSITA. Kwark provides data at 900 and 1000 degrees
7 Celsius. This is consistent with Froitzheim and overlaps with Froitzheim's
8 range.

9 As you can see at the top of Figure 4, aluminum contact, AL contact,
10 is a diffuse emitter of Froitzheim. And if you look at the finding at the far
11 end at 1000 degrees, the polysilicon emitters with the chemox sample have
12 the lowest J naught. This is lower compared to the no chemox samples and
13 lower compared to the diffuse emitter of Froitzheim, the aluminum contact.
14 This is true even at 1000 degrees C. The advantages are certainly higher at
15 900, but it's true throughout the first 100 degrees of Froitzheim's range.

16 We see on the next slide Patent Owner's expert, Dr. Ruby, admits
17 even at 1000 degrees, the with chemox samples have a lower recombination
18 than the no chemox samples, and it's true that also that 1000 degrees, the
19 with chemox samples have a lower recombination than the aluminum
20 contact diffuse emitter, which is akin to Froitzheim. Thus, a POSITA would
21 be motivated to combine Froitzheim and Kwark.

22 Turning to reasonable expectation of success, the institution decision
23 correctly found that a POSITA would have had a reasonable expectation of
24 success in combining Froitzheim and Kwark to achieve the claimed
25 invention. If we turn to Slide 31, as with Gan, Petitioner's combination of
26 Froitzheim and Kwark is a straightforward substitution of Froitzheim's

1 diffuse emitter with a polysilicon emitter this time having interfacial
2 chemical oxide as opposed to Gan's thermal oxide.

3 Turning to Slide 32. Patent Owner argued that a POSITA would not
4 have success in combining Froitzheim and Kwark because the contact
5 resistance of the resulting cell would be too high. For that, Patent Owner
6 relies on the Gan these, which describes Kwark's chemical oxide as
7 resulting in a high rho C.

8 But Patent Owner's expert, Dr. Ruby, recognizes in paragraph 64 of
9 his declaration, Exhibit 2020, that 1 sun solar cells like Petitioner's proposed
10 combination only require a contact resistance of less than 1 times 10 to the
11 minus 2. That is much, much higher than 4 times 10 to the minus 4 -- 2
12 orders of magnitude higher. Accordingly, even if the proposed Froitzheim
13 combination with Kwark results in a slightly higher contact resistance, a
14 person of ordinary skill in the art would have a reasonable expectation of
15 success because the contact resistance is suitable for a 1 sun solar cell
16 context.

17 Turning to Slide 30 -- sorry. Were you going to ask a question, Your
18 Honor? Okay. The thing lit up. Thank you.

19 If we turn to Slide 33, Patent Owner also argues that a person of
20 ordinary skill in the art would not be able to reliably grow a chemical oxide
21 layer. This is incorrect. Dr. Banerjee explained in his deposition that
22 chemox growth is a mature science. As we discussed a few slides earlier,
23 Kwark grows a chemox layer using a method called RCA cleaning. Dr.
24 Banerjee confirmed this method has been done for 30 to 40 years. It's a
25 very standard procedure. And as Dr. Banerjee explained, in the controlled
26 case of the no chemical oxide in Kwark, the oxide was etched off using HF,

1 hydrofluoric acid. The hydrofluoric acid is not part of the process to
2 actually form the interfacial oxide; it's removing the interfacial oxide.

3 If we turn to the Petitdidier reference, Patent Owner claims it is not
4 similar to Kwark, but that is wrong. Petitdidier also discussed the RCA
5 cleaning process, treated using an alkaline ammonia-hydrogen peroxide
6 mixture to create a chemical oxide layer. This is the same standard RCA
7 process in Kwark. And again, Petitdidier supports Dr. Banerjee's testimony
8 that a person of ordinary skill would be very comfortable generating
9 chemical oxide layers. It reports that RCA has been widely used in the
10 semiconductor industry of which solar cells are a type of semiconductor, and
11 it cites to a publication from 1970, many, many decades ago.

12 Patent Owner's Surreply in discussing Petitdidier inaccurately
13 suggests that the hydrofluoric acid was part of the RCA cleaning process to
14 generate a chemical oxide. This is not correct. That was part of the process
15 to generate the control, the no chemox sample. Thus, this attorney argument
16 regarding the paper should be disregarded.

17 If we turn to Slide 35, the record is replete with additional evidence
18 that generating a chemical oxide is well known in the art. In fact, Dr.
19 Banerjee described that he teaches this to his undergraduate students.
20 Certainly, to a person of ordinary skill in the art with an advanced degree
21 and ten years of research experience, it would be well known.

22 Patent Owner also argues that a person of ordinary skill would not be
23 able to reliably grow a chemical oxide because Petitioner did not specify a
24 particular time and temperature for the chemox growth. As an initial matter,
25 this was a new argument raised in the Surreply that could have been raised
26 in the Patent Owner Response and was not. But regardless, it's not

1 supported. A person of ordinary skill could vary the time and temperature to
2 vary the thickness of the oxide, including using optimization techniques
3 reported in Petitdidier, and varying such parameters does not generate
4 uncertainty; it's simply routine optimization.

5 As Dr. Banerjee explained, the variation of the thicknesses is not
6 going to be large. It will be in the range of 10 to 20 angstroms. Thus, even
7 among shifting parameter, it's within a small range of possible thicknesses.
8 In addition, the claims do not specific any required time or temperate, and,
9 in fact, neither does the specification. The only example given is to generate
10 a thermal oxide layer in the range of 10 to 50 angstroms, a wider range than
11 Dr. Banerjee testified he could achieve using a standard RCA clean.

12 Patent Owner also argues, if we turn to Slide 37, that there would be
13 no reasonable expectation of success in achieving a favorite J naught using
14 Froitzheim's preferred range. Patent Owner drew red lines to claim that the
15 J naught would continue to increase linearly at the same slope, but Patent
16 Owner provided no explanation as to how it's possible that the J naught of a
17 broken up chemical oxide could be higher and somehow exceed a control
18 version where there is no chemical oxide at all. This should be disregarded
19 as unsupported attorney argument.

20 As we'll see on Slide 38, though the annotations appear in Dr. Ruby's
21 report, he did not generate them himself. He reprinted what his attorneys
22 gave him. Instead, as explained by Dr. Banerjee, it's much more likely that
23 the J naught value will asymptote towards the no chemox value and flatten
24 out just below the no chemox value. Indeed, even Dr. Ruby, as we see in the
25 top right of the slide, concedes it's not going to continue to increase slightly
26 linearly. Thus, even if adopting Froitzheim's preferred range, which a

1 POSITA would not to do because a POSITA would exercise ordinary
2 creativity to select a lower end of the range for doping a polysilicon emitter,
3 you'll still see an advantage from using a chemical oxide and polysilicon
4 emitter as compared to the diffused emitter of Froitzheim.

5 JUDGE KALAN: In interpreting this graph, is there any significance
6 to the convergence determination at about 1000 C? The data doesn't just
7 stop there. You're saying the extrapolation could happen. It's just going to
8 look different than the red lines.

9 MS. BOLL: So there is no significance to that because a POSITA
10 would just conduct the doping below 1000 degrees Celsius, but regardless,
11 even at 1000, you still see quite a bit of separation. It's a little bit hard to tell
12 with the scale, but maybe half or so of an order of magnitude at 1000
13 degrees between the diffused emitter, which is the aluminum contact, and
14 the chemical oxide. So a person of ordinary skill would still recognize a
15 significant benefit at 1000 degrees.

16 JUDGE KALAN: And on the Y-axis, J naught there, it's shown as J
17 naught E. Is there any difference?

18 MS. BOLL: So I believe both experts agree that the two are used
19 interchangeably. E refers to emitter, and I think this appears in Dr.
20 Banerjee's deposition, Exhibit 2023, at page 107, and Dr. Ruby's deposition,
21 Exhibit 1066, at page 83. So the experts agree that this is interchangeable.

22 With my remaining time, I'd just like to briefly touch on
23 accommodation of Froitzheim and Borden for which -- oh, sorry. Are there
24 any other questions on Froitzheim and Kwark before I move on?

25 Okay. So if we turn to Slide 39, Froitzheim and Borden could be
26 readily combined as Borden's invention explicitly relates to improved

1 polysilicon emitter solar cells with tunnel oxide. There are various benefits
2 that Borden described, and if we turn to Slide 40, Dr. Banerjee explained
3 and the Petition explained these benefits do apply to a polysilicon emitter.

4 And if we turn to Slide 42, the testimony elicited by Dr. Banerjee
5 during his deposition confirmed the key teaching in Borden is the use of the
6 interfacial oxide. In the polysilicon context, the Borden benefits still apply
7 as it would help minimize the epitaxial growth of the polysilicon as well as
8 minimize any plasma damage. Thus, at least those two benefits described in
9 Borden would motivate a POSITA to pursue to the combination.

10 And with that, unless there are questions, I will reserve my remaining
11 time for rebuttal.

12 JUDGE KALAN: One more question about the secondary
13 considerations argument or non-argument. Is your position that it's not an
14 argument that we have to address in our decision?

15 MS. BOLL: So the objective factors, in Petitioner's view, do support
16 obviousness. There is no evidence of commercial success as the product that
17 SunPower, who is the predecessor to Patent Owner, developed are not back
18 contact solar cells. And in addition, there were no unexpected results, and I
19 believe that's explained in our Petition at pages 68 to 69.

20 JUDGE KALAN: Any other questions from the panel?

21 Eight minutes remaining, and we'll turn it over to Patent Owner, if
22 you would like to begin.

23 MR. PETERSON: Thank you, Your Honors. Do you mind if I share
24 my screen as well?

25 JUDGE KALAN: Go ahead. Thank you.

1 MR. PETERSON: Okay. Again, good afternoon, Your Honors.
2 Turning to Demonstrative 3 --

3 JUDGE ROSS: You know, Mr. Peterson, just a second. I want to
4 make sure that we're all on the same page. Petitioner said that there were
5 some non-disputed issues, and I believe it was Slide 4, Petitioner's Slide 4.
6 Do you agree that those are undisputed issues?

7 MR. PETERSON: Let me look at -- I'll bring up Petitioner's Slide 4.
8 Well, we agree that the proposed combinations meet all of the
9 elements except for Claim 12 of the '516 patent, so we agree with that. We
10 did not argue anything about the Hartiti or Sivoththaman references because
11 our position is that the main references, Gan and Froitzheim, Froitzheim and
12 Kwark, and Froitzheim and Borden, that cover the independent claims, are
13 the only thing that's necessary to show that there's no motivation to
14 combine. So Hartiti and the other reference, those deal with the dependent
15 claims other than Claim 12 of the '516 patent. And we also did not argue
16 secondary considerations of non-obviousness.

17 JUDGE ROSS: Okay. Thank you. And then on the next page, I just
18 want to confirm these are the disputed issues as everybody kind of agrees to.
19 Right here, yes. Slide 5.

20 MR. PETERSON: Yes.

21 JUDGE ROSS: Okay. I do have a quick question about the 01040
22 case. On the slide that we were just looking at, it shows teaching away as
23 one of the arguments that Patent Owner presented, but I don't see that in the
24 briefing.

25 MR. PETERSON: 01040?

26 JUDGE ROSS: Yes.

1 MR. PETERSON: I'm sorry. What are you referring to?

2 JUDGE ROSS: Under both the Froitzheim and Gan combination and
3 the Froitzheim and Kwark combination, the very last thing that the disputed
4 issue says teaching away. And so my question to you is, is Patent Owner
5 arguing a teaching away in the 01040 case? I may have had too many zeros
6 in there. I'm not sure. And if so, where is that in your briefing?

7 MR. PETERSON: I don't believe we are arguing -- well, it's a more
8 subtle than -- it's not a straight teaching away. What we're saying is that
9 given everything, you would not have a motivation to combine or reasonable
10 expectation of success. And I guess you could think of it as a teaching
11 away, the whole combination, but we didn't state it as a teaching away.

12 JUDGE ROSS: Okay. Fair enough. Thank you very much for the
13 clarification.

14 MR. PETERSON: Is that it? Okay.

15 So turning to Demonstrative Slide 3, Petitioner's obviousness
16 combination for the Froitzheim-Gan combination, takes the silicon and
17 doping steps in Froitzheim and the oxide in polysilicon from Gan. Let me
18 lay out Patent Owner's arguments in a nutshell. Petitioner wants you to look
19 at one thing or another but not both things in combination. There are two
20 Gan references in this case. Both are authored by the same person, one
21 which I will refer to as the Gan reference. The Petitioner uses the Gan
22 reference as prior art, and it is Exhibit 107 in these matters -- 1007. The
23 other is a more comprehensive work on the same exact subject as the Gan
24 reference. This is the thesis, the Gan thesis, used to discuss the teaching of
25 the Gan reference but in more detail. I will refer to this as "the Gan thesis,"
26 and it is Exhibit 2003 in these matters.

1 The Gan thesis was published shortly after the Gan reference was
2 published. So if Gan isn't a POSITA as of the Gan thesis, the Gan reference
3 was actually published before the thesis, so I don't understand how
4 Petitioner can state that Gan is not a POSITA as of the time of the Gan
5 thesis, but he was at the time of the Gan reference. Moreover, the Gan thesis
6 and the Gan reference both discuss the same experiments.

7 Gan said in the Gan thesis that he was not able to get tunnel oxide to
8 work consistently or reliably. He said, quote, "It is not possible to have
9 good control over the characteristics of a polysilicon SIS emitter," unquote.
10 He also said, quote, "It becomes clear that the wide fluctuation of our results
11 is mainly due the poor control over the oxide thickness." He also said, "The
12 effects of the oxide thickness cannot be ignored. This combined with the
13 non-reliable oxide-growth recipe gives rise to the mishap of our solar-cell
14 runs."

15 He concluded his study saying that it was difficult to get a consistent
16 resistance, resistant result, and it was difficult to reproduce, that the thin
17 oxide growth recipe was not reliable and that it was necessary to have
18 precise control of the oxide thickness. He also said that for future study, a
19 more reliable way of growing thin oxide is needed. Therefore, Gan himself
20 was not able to get his findings in the Gan reference or the Gan thesis to
21 work consistently or reliably. Gan was proposing a future study, not to put
22 his results right into practice.

23 We believe this is enough to show that a POSITA would not be
24 motivated to take the teachings of the Gan reference, which the Gan thesis
25 tells us are pretty spotty at best, and combine them with Froitzheim. But on
26 top of that, Gan also showed that the temperatures above 1000 degrees

1 mitigate the benefits of the tunnel oxide. Froitzheim proposes a tunnel range
2 of 900 to 1200 degrees centigrade as the second-step anneal temperature,
3 preferably between 1000 and 1100 degrees centigrade. The lower range of
4 900 to 1000 degrees is outside of the preferred range because it would cause
5 the dopants to not drive in fully, causing a shallower junction. In other
6 words, it would make Froitzheim's embodiment a worse embodiment.

7 However, Petitioner is saying you should go with the lower bounds of
8 Froitzheim's second-step anneal temperature range. So to accept
9 Petitioner's argument, a POSITA would have to be motivated to take a
10 tunnel oxide that was already not consistent or reliable and change the times
11 and the temperature outside the preferred range of Froitzheim, thereby also
12 giving suboptimal dopant drive-in and junction depth.

13 Petitioner has not shown that its proposed combination would work
14 better than the prior art, Froitzheim itself, under these substandard
15 conditions. Therefore, Petitioner has not shown why a POSITA would have
16 been motivated to combine Froitzheim and Gan. Patent Owner does not
17 think that this would rise to a reasonable probability of success, especially
18 when you're starting with a base, which the author himself argued was
19 difficult to reproduce.

20 Turning to Slide 4. Petitioner argues that the proposed Froitzheim and
21 Gan combination does not achieve specific J_{naught} and ρC values. The
22 part that the Petitioner quotes and the part that Patent Owner quotes
23 regarding the usefulness of Gan, whether it's speaking to silicon
24 concentrator solar cells or silicon solar cells generally is that J_{naught} is
25 below 5 times 10 to the minus 14.

1 Now let's look at how this number can be achieved in the proposed
2 Froitzheim-Gan combination, if at all. Turning to Demonstrative 5,
3 Froitzheim's anneal temperature is relevant because Patent Owner and its
4 expert propose implementing some of Gan's steps to form the polysilicon
5 emitter and the oxide layer and then using Froitzheim's anneal temperature
6 for the second-step anneal.

7 Turning to Slide 6. Dr. Banerjee, Petitioner's expert, confirms that
8 Patent Owner's proposed combination uses Froitzheim's anneal steps.
9 Turning to Slide 7. Froitzheim proposes using a second-step anneal
10 temperature of 900 to 1200 degrees centigrade and preferably a temperature
11 between 1000 and 1100 degrees centigrade to generate the oxide layer and to
12 drive in the dopant. Notice Froitzheim is silent regarding how long the
13 dopant drive-in step is conducted. So if we go with Froitzheim's second-
14 step anneal, we don't even know the time that they would be using for the
15 specific temperatures, whether it's 900 or 1000 degrees. We don't know
16 how far the dopant is going to be driven in, and we don't know how much
17 oxide breakup we're going to get because those things both depend on
18 temperature and time.

19 JUDGE ROSS: Let me just jump in and ask a quick question. Isn't
20 that something that a person of ordinary skill in the art would know how to
21 achieve, adjusting the temperature and adjusting the time?

22 MR. PETERSON: Well, that hasn't been argued or proven, so would
23 say not on the record before us.

24 JUDGE ROSS: And does your expert say that it's something that a
25 person of ordinary skill in the art would not know how to do?

26 MR. PETERSON: No, he has not said that.

1 JUDGE ROSS: Okay. Thank you.

2 JUDGE KALAN: While we're asking questions, I wanted to ask you
3 the same question I asked Petitioner's counsel about the Gan thesis, which
4 you talk about on page 11 of your Response. What's the role of the Gan
5 thesis in our analysis of the asserted grounds and the records on which they
6 rely?

7 MR. PETERSON: Well, the Gan thesis is very important as I'll
8 explain later. I mean, the Gan thesis is a greater work that's discussing the
9 Gan reference. The Gan reference is the same experiment as the Gan thesis,
10 but the Gan thesis goes into more background, it goes into more how the
11 experiments were carried out, and it goes into the failings, which the Gan
12 reference does not. \ So a person of ordinary skill in the art is supposed
13 to know about all of the prior art that's out there. The Gan thesis is just as
14 important as the Gan reference. Petitioner wants you to forget about the Gan
15 reference, and you did for the most part in the ID, but that was because prior
16 counsel didn't actually get an expert to determine when the Gan thesis was
17 on the shelf. We fixed that problem and explained why it's important and
18 also further elucidated the issues that the Gan thesis said that it had with the
19 experiments that it carried out in the Gan reference.

20 Does that answer your question?

21 JUDGE KALAN: I'm still unclear as to how it fits into our
22 framework for analysis because we are relying on the Gan reference. The
23 Gan thesis, although explanatory, doesn't have identity with the Gan
24 reference unless there is something you can point to in the record that shows
25 us they're effectively one and the same. I think we are supposed to look at
26 Gan for what it stands for, but I'm still interested in hearing your position on

1 how the Gan thesis should be considered as supplemental or side-by-side or
2 identical.

3 MR. PETERSON: Supplemental, Your Honor. The Gan thesis was
4 printed or published a month and a half to two months after the Gan
5 reference. The Gan thesis has the same thesis advisor as the secondary
6 author on the Gan reference. So it's the same work. It's literally the same
7 experiments, just in more detail. So we would ask that you consider it as a
8 supplementary reference.

9 Would you like me to continue, Your Honor, or do you still have
10 further questions? Your Honor, can you hear me?

11 JUDGE KALAN: I said please go on.

12 MR. PETERSON: Oh, I'm sorry. I didn't hear you. Turning to Slide
13 Demonstrative 8, Table 1 of the Gan reference shows that as the temperature
14 and time of the second-step anneal increase, the value of J_{naught} increases,
15 which is not a desired result. Table 1 also shows that the dopant drive-in at
16 1000 degrees Celsius, even for 30 minutes, results in a value, J_{naught} of 8
17 times 10^{-14} for P-type, both of which are higher than what Gan
18 was trying to achieve. In other words, at 1000 degrees Celsius, the test
19 failed Gan's own test.

20 Table 1 at the P-type column is particularly relevant because
21 Petitioner specified that the proposed combination, including Froitzheim's
22 N-type substrate and Gan's P-type emitter were used. Even at the lowest
23 anneal temperature Froitzheim discloses, 900 degrees Celsius, the resulting
24 Froitzheim-Gan combination, would yield a resistance value that is higher
25 than what Gan finds useful. If a POSITA followed Froitzheim's preferred
26 temperature of 1000 to 1100 degrees Celsius, the resulting Froitzheim-Gan

1 combination would also yield a value of J_{naught} that Gan finds
2 unacceptable. Petitioner's claim that non-concentrator cells can work with a
3 higher series resistance than what is required by a concentrator solar cell is
4 not relevant. The parties' dispute is over Gan's contact resistivity, not series
5 resistivity.

6 Turning to Slide 9. On the left is Figure 6 of the Gan reference. This
7 graph shows that the higher the temperature of the second-step anneal, the
8 higher the J_{naught} . In fact, the figure shows much lower J_{naught} values
9 for the 900 degrees Celsius anneal than for the 1000 second-step anneal.
10 Gan then discusses this figure and observes for regime 1, 900 degrees
11 Celsius, J_{naught} is almost constant while resistivity drops drastically. And
12 for regime 2, which is at 1000 degrees, resistivity decreases very slowly and
13 J_{naught} is in a much faster pace.

14 Simply put, while Gan teaches better results are achieved when the
15 second anneal to drive in dopants is at 900 degrees Celsius or below,
16 Froitzheim teaches that the temperature to drive in dopants is preferably at
17 1000 to 1100 degrees Celsius. Consequently, following Froitzheim's
18 teaches nullifies the benefits sought by Gan, and following Froitzheim's
19 lower annealing temperature prevents realizing the junction depth and
20 doping concentration achievable when the dopants are driven in at the higher
21 temperatures taught by Froitzheim. By decreasing this temperature, you are
22 moving away from the doping concentrations that Froitzheim is teaching are
23 best.

24 JUDGE ROSS: Mr. Peterson, may I interrupt a minute, please?

25 MR. PETERSON: Sure.

1 JUDGE ROSS: So I understand your argument that 1000 degrees and
2 greater is preferable in Froitzheim, but I'm having a hard time understanding
3 how we can just jettison the teachings in Froitzheim that also discuss 900
4 degrees as being okay. Can you speak to that a little bit?

5 MR. PETERSON: Yes, Your Honor. We're not asking you to
6 jettison the 900 to 1000 degree range. Okay? We're asking you to look at
7 all of the evidence. You look first at Gan disparages his use of oxide. He
8 wasn't able to get it to work. He talked about how you could maybe get it to
9 work reliably in the future, but as of the Gan reference date and the Gan
10 thesis date, he wasn't able to get it to work. So --

11 JUDGE ROSS: Let me just ask a follow-up question there, because I
12 think this will help clear up the record a little bit. When you're talking about
13 Gan not getting it to work, does it say that in the Gan reference or in the Gan
14 thesis?

15 MR. PETERSON: In the Gan thesis because the Gan thesis is
16 actually putting more detail about the experiments that went on in the Gan
17 reference.

18 JUDGE ROSS: Fair enough. I understand. I just wanted to make
19 sure we were keeping them clear. Thank you.

20 MR. PETERSON: It's the Gan thesis, Your Honor.

21 So in combination with that, that's the starting point. We can't get this
22 oxide polysilicon theory and experiment to work. Now let's take it and let's
23 combine it with Froitzheim and use the non-preferred range, which drops
24 down the junction depth and how far the dopants get moved in, so now
25 you're making Froitzheim worse than it actually was. So would a POSITA,
26 knowing all of that, be motivated to make this combination at all?

1 So we're not saying jettison the 900 to 1000. We're just pointing out
2 that not only are you starting with Gan these telling you that he wasn't able
3 to get the oxide layers to work, but then you're adding in a non-preferred
4 range, which also has consequences. And it hasn't been shown that that
5 combination would work better than Froitzheim itself.

6 JUDGE ROSS: Okay. But would you agree with me that both Gan --
7 not the Gan thesis, just Gan -- and Froitzheim seem to suggest that the
8 combination would work at 900 degrees?

9 MR. PETERSON: It would work, but we know that it would work
10 worse.

11 JUDGE ROSS: And how do we know that?

12 MR. PETERSON: Because we have testimony from Petitioner's
13 expert that says when you go to the lower range, the dopants are not driven
14 in as further, and this would affect the junction depth.

15 JUDGE ROSS: Okay. And so that would be with respect to
16 Froitzheim? It wouldn't work as well as Froitzheim discusses?

17 MR. PETERSON: Right.

18 JUDGE ROSS: Okay. Got it. Thank you.

19 MR. PETERSON: You're welcome.

20 Turning to Slide 10. Petitioner argues that a POSITA would have
21 readily reconciled the teachings of Gan and Froitzheim regarding processing
22 temperatures by selecting the lower end of the Froitzheim range. This is a
23 naked assertion without any evidence. The Petitioner's burden is to prove
24 unpatentability by a preponderance of the evidence.

25 Petitioner falls far short of this mark. Both anneal temperature and
26 anneal time are crucial to achieving Gan's targeted J naught in resistance

1 values because the degree of breakup of the interfacial oxide depends on
2 both variables. Thus, when Gan thesis documents variations in J_{naught} , it
3 specified both the anneal temperatures and the anneal time that resulted in
4 the values of J_{naught} and ρ_{sub-C} . This is also true with the Gan
5 reference. But Petitioner proposes using Froitzheim's anneal temperatures
6 and times. Froitzheim doesn't even give it time.

7 Petitioner notes that Gan's polysilicon emitter has different diffusion
8 profile dopant depth based upon annealing conditions and Froitzheim's
9 monocrystalline silicon substrate. Therefore, by using Froitzheim's dopant
10 steps, you are further harming any benefits you would get from Gan.
11 Moreover, Petitioner has not provided the anneal time that should be used,
12 and without it, the dopant profile remains unknown.

13 Petitioner's argument that Froitzheim diffusion temperatures would
14 work on Gan's emitter is based on its expert witness opining about the
15 Merabet reference. Petitioner argues that a POSITA would choose
16 Froitzheim's lower temperature range, which is unsupported. Merabet
17 applies higher diffusion temperatures than what Petitioner proposes. It
18 proposes 1000 degrees to 1150. Therefore, Merabet shows that Froitzheim's
19 preferred higher range should be used, which would negate the value of the
20 additional of the tunnel oxide.

21 Petitioner has also provided conflicting evidence on the effect of the
22 different temperatures. Petitioner's expert testified that increasing the
23 temperature means increased diffusion, but Merabet suggests increased
24 temperature equals less diffusion. Therefore, it is not just the simple matter
25 of a POSITA picking the lower temperature range.

1 Turning to Slide 11. We've just gone through the problems with the
2 proposed Froitzheim-Gan combination, but a POSITA would also know
3 Gan's other writings on the subject, specifically the Gan thesis.

4 Turning to Slide 12. On the left is the cover of the Gan reference, or
5 Exhibit 1007. This is prior art used by Petitioner. On the right is the cover
6 of the Gan thesis. So initially, the Board didn't look to the Gan thesis at all
7 because its publication date was not shown, but now we actually have an
8 expert that showed when it was on the stacks. The librarian declaration is
9 Exhibit 2022 in both of the IPRs. Further, as I stated earlier, the Gan thesis
10 and the Gan reference are dated just over a month from each other, and the
11 Gan thesis is actually in July, whereas the Gan reference is in May of 1990.

12 As I stated earlier, the Gan thesis advisor is R.M. Swanson, and he is
13 also the second author on the Gan reference. The Gan thesis is also
14 important because it discusses the findings of Kwark as well and teaches
15 why a POSITA would not want to use chemox to create an oxide layer like
16 Kwark proposes.

17 Turning to Slide 13. The Gan thesis reveals that the author faced two
18 main problems that he could not overcome, oxide thickness and oxide
19 breakup. Specifically, the Gan thesis shows that the oxide growth recipe
20 used in the Gan thesis and the Gan reference lead to a wide variation of
21 oxide thicknesses, which cause problems. The Gan thesis showed that using
22 Gan's method meant you would get inconsistent and unreliable results.

23 Turning to Slide 15. Petitioner claims that the Gan thesis proposed a
24 solution to its own problem is equally meritless. The Gan thesis merely
25 considered an unproven assumption. Contrary to Petitioner's assertion, a
26 POSITA would have seen this as speculation at best, not a concrete solution.

1 Turning to Slide 16. Now we'll change gears to the Froitzheim-
2 Kwark combination. Do I have any questions on Froitzheim and Gan before
3 I continue? Okay.

4 As the Board can see from the illustration provided in the petition, the
5 proposed Froitzheim-Kwark combination includes Kwark's polysilicon
6 emitter in red and interfacial oxide layer in green. In Kwark, this interfacial
7 oxide is a chemical oxide or a chemox. The Gan thesis discusses Kwark and
8 even uses the same diagram that Petitioner relies on. So the diagram that
9 Ppetitioner was just showing you in Kwark, that's actually in the Gan thesis.

10 So Kwark was art that was around before the Gan thesis. Moreover,
11 one of Kwark's authors is also the same R.M. Swanson, who was the second
12 author in Gan and the thesis advisor on the Gan thesis. So anybody looking
13 at Kwark would know about Gan, the Gan reference, the Gan thesis, and
14 would know that the saturation current J_{naught} in resistance issues in
15 Froitzheim preferred temperature range would also be present and would
16 know that moving out of Froitzheim preferred temperature range would
17 cause dopants not diffused to their optimal level and cause a shallower
18 junction.

19 Further, the Gan thesis taught that chemox use had serious issues.
20 The Gan thesis explains that the contact resistance, ρ_{sub-C} , when using
21 chemox was four times higher than the goal of the Gan thesis, and the
22 potential drop across the polysilicon emitter would be intolerable. Kwark
23 itself tells us that the out diffusion from the heavily doped poly becomes
24 significant for annealing temperature above 900 degrees. Kwark also says
25 that at 1000 degrees Celsius, this diffusion is severe enough to dominate the
26 J O E, which accounted for the lack of difference between emitters B and C.

1 Also, as I will discuss later, many other references disparage the use of
2 chemox.

3 Petitioner's claim that a POSITA would have been able to modify the
4 thickness of Kwark's chemox to reduce its resistivity is an impermissible
5 new argument. Effectively, Petitioner's claim that a POSITA, considering
6 the proposed Froitzheim-Kwark combination, would have looked at
7 techniques disclosed in Petitdidier to adjust Kwark's chemox layer. This is
8 also a new argument, relying on a new reference, which isn't proper.

9 Also, the oxides discussed in Petitdidier and Kwark are different. One
10 is a protective insulation layer and one is a tunnel oxide. Second, the two
11 chemox layers are formed differently with different types of mixtures.
12 Third, the chemoxes have different properties. Kwark's is a thin tunnel
13 oxide, and Petitdidier isn't even a continuous film, so it can't even work as a
14 tunnel oxide. Most importantly, the tunnel oxides need to be between 10
15 and 50 angstroms, but Petitdidier only teaches how to grow an oxide layer
16 less than 10 angstroms, so it doesn't even teach you how to grow the type of
17 tunnel oxide that Kwark used at all. Thus, Petitioner's argument should not
18 be considered.

19 Moreover, even knowing about Kwark, even having the same second
20 author as Kwark, Gan was still not able to get the oxide layers to work
21 consistently and reliably, even with shared co-authors and thesis advisor.
22 Therefore, a POSITA would not know whether it is better to stick with the
23 structure proposed by Froitzheim or deal with the consistency and reliability
24 issues that adding a tunnel oxide creates, nor has it been shown that the
25 combination of Kwark with Froitzheim would work better in terms of
26 resistance or saturation currents in the structure taught by Froitzheim alone.

1 Turning to Slide 18. Kwark's chemox only works at low temperature
2 anneals. The annealing process referenced above is the step to drive in the
3 dopants into the polysilicon layer. Kwark tells itself that outdiffusion from
4 the heavily doped poly become significant for annealing temperatures above
5 900 degrees and that outdiffusion is severe enough to dominate J O E at
6 1000. Therefore, Kwark and Gan tell us the same things. They're telling us
7 the same thing, that you should be at the 900 to 1000, but at 1000 and above,
8 you've killed the J O E of the J naught.

9 Turning to Slide 19. The Gan thesis looked at Kwark and said that the
10 resistance for using chemox in the polysilicon emitter would be intolerable,
11 but even further than that, we see the figures that Petitioner was looking at
12 earlier. Like Gan, Kwark identified the higher than desired J naught values
13 at anneal temperatures of 900 degrees. Specifically, Kwark explains that
14 Figure 4 displays the resulting J naught as a function of annealing
15 temperature for emitter B.

16 JUDGE KALAN: Can you explain the extrapolation of the circle?

17 MR. PETERSON: Sure. The extrapolation of the circle, that was just
18 an extrapolation, but it goes along with -- hold on. The extrapolated lines
19 match what Kwark himself said. Kwark itself disparaged going above 1000
20 degrees Celsius. Kwark himself says that increasing the annealing
21 temperature to 1000 degrees Celsius adversely affected J naught. Kwark
22 also said that at 1000 degrees, this outdiffusion is severe enough to dominate
23 J O E.

24 So you don't have to take those lines for it. Kwark is explaining that
25 that is exactly what's happening. And we don't have the actual values, but
26 we know that it's trending up towards where it would have no chemox, and

1 that's pretty much what those lines show. We were just extrapolating them
2 to help show visually what it would look like.

3 JUDGE KALAN: Again, the basis for that extrapolation would be
4 found within Kwark itself or in the expert's --

5 MR. PETERSON: Kwark itself. What I just read to you was from
6 Kwark itself, Your Honor.

7 JUDGE KALAN: Petitioner indicated that those lines would likely
8 level off to the point where they were --

9 (Simultaneous speaking.)

10 MR. PETERSON: They would likely go to where there is no chemox,
11 so you see the two lines to the left, right where they start to go off the page,
12 they would probably get to that point and stay at that point.

13 JUDGE KALAN: So it's not reflective of current permutations of
14 that.

15 MR. PETERSON: Turning to Slide 20. Petitioner does not dispute
16 that at Froitzheim's preferred temperature range of 1000 to 1100, Kwark's
17 purported benefits would be lost. Petitioner reverts to its conclusory
18 statement that a POSITA would understand to apply the lower end of the
19 preferred temperatures disclosed in Froitzheim. Not only is 900 to 1000
20 degrees outside of Froitzheim preferred temperature range, but such mere
21 conclusory statements are insufficient.

22 Also, Petitioner's own expert explained that reducing the temperatures
23 would decrease the dopant diffusion and decrease junction depth, therefore
24 harming the embodiment over what is in the preferred disclosure. Therefore,
25 a POSITA would have no way of knowing whether the proposed
26 combination would work better than the device disclosed by Froitzheim

1 itself without modification. Froitzheim itself was designed for improved
2 stability and efficiency, so if you believe that, it would probably have a
3 better value than the AI contact -- or the AL contact -- up there. Petitioner
4 never explains why a less efficient Froitzheim combination would be better
5 than the Froitzheim which has improved stability and efficiency.

6 Turning to Slide 21. Patent Owner's second argument against
7 combining Froitzheim and Kwark is that a POSITA would not have had
8 reasonable success implementing Kwark's chemox in Froitzheim.

9 Turning to Slide 22. The Gan thesis undermines Petitioner's alleged
10 motivation to combine Froitzheim and Kwark. The Gan thesis includes
11 Figure 3.6, which is left, which is identical to Kwark's Figure 4. Gan's
12 thesis shows very similar results to Kwark. Like Gan, Kwark's saturation
13 current loses almost all benefits as you approach 1000 degrees Celsius.
14 While it is true that looking in Figure 4 in isolation, you would think that the
15 solar cell with an aluminum contact might be worse than the solar cell with
16 chemox and polysilicon.

17 However, a POSITA would know more than to look at just Figure 4 in
18 isolation. They would know that Gan thesis looked at Kwark and was not
19 able to get the tunnel oxides to work consistently and reliably. Also,
20 chemox is a very crude form of creating silicon dioxide, and this may be the
21 reason why Kwark failed to create a uniform oxide layer and experienced
22 significant increases in J O. Plus, the Gan thesis looked at Kwark and saw
23 that it had serious issues and said that the resistance would be intolerable.

24 Also, many other references also disparage the use of chemox as
25 inferior, as having less thermal stability, having poor control over oxide
26 thickness, as being chemically unstable, and breaking up during the emitter

1 drive-in steps. Basically the same problems that Gan was having in the Gan
2 thesis with thermal oxide, the other references are saying are issues with the
3 chemox in Kwark.

4 Further, as discussed previously, without providing specific anneal
5 temperatures and anneal times, a dopant profile of Kwark's polysilicon
6 emitter in the proposed Froitzheim-Kwark combination would be unknown.
7 Therefore, a POSITA would not have had a reasonable expectation of
8 success in using this chemox layer.

9 Turning to Slide 23. Looking at the proposed Borden combination,
10 Froitzheim-Borden combination, as the Board can see from this illustration
11 provided in the petition, the proposed Froitzheim-Borden combination
12 includes Borden's polysilicon emitter and interfacial oxide layer. Emitter is
13 in red; the oxide is in green. The Borden reference describes HIT cells, H-I-
14 T cells, which are solar cells that do not use a polysilicon emitter. There is
15 no reason to combine Borden with Froitzheim because the benefits regarding
16 motivation to combine that Petitioner touts are directed to HIT cells solely,
17 not to the embodiment with the polysilicon emitter.

18 Borden teaches two different embodiments, one with a layer of
19 silicon, a layer of silicon dioxide, and then two layers of amorphous silicon.
20 This is the HIT cell. Another embodiment proposes removing the two layers
21 of amorphous silicon and replacing them with polysilicon. This is the
22 embodiment that Petitioner proposes to use. Borden expressly distinguishes
23 HIT cells from polysilicon emitter cells.

24 According to the Petitioner in the petition, a POSITA would have
25 been motivated to make this combination because the oxide layer prevents
26 its epitaxial growth, allowing for optimal band structure and provides a layer

1 to protect the surface from plasma damage. As you can see above in the
2 abstract, Borden only attributes these attributes to the HIT cells with
3 amorphous silicon, not to the embodiment where the emitter is polysilicon.

4 Moreover, when amorphous silicon is removed, these benefits do not
5 apply to the combination, because according to Borden, these benefits only
6 apply to the amorphous silicon. Dr. Banerjee, Patent Owner's expert, stated
7 that the amorphous growth to epitaxial silicon would not be a benefit when
8 the polysilicon replaces the amorphous silicon. The abstract itself tells us
9 that if you are not depositing an amorphous silicon layer, you would not get
10 the plasma damage. In other words, the important benefit that tunnel oxide
11 gives you is solely related to amorphous silicon.

12 Dr. Banerjee tried to cover these benefits to the deposition of the
13 polysilicon layer, but these benefits are not stated by the prior art references
14 themselves, nor does Petitioner show that polysilicon is being deposited by
15 plasma-enhanced deposition as they said. In its Reply, Petitioner references
16 for the first time Borden's additional stated benefit of increased efficiency
17 with a point contact structure. Arguing this new benefit at this stage is
18 improper and should not be considered.

19 But aside from being improper, Petitioner's new argument is
20 meritless. They did not show anywhere where the proposed Froitzheim-
21 Borden combination actually includes a point contact structure. Explain
22 how a POSITA could have adopted a point contact structure or why a
23 POSITA would have been motivated to combine at a point contact structure.

24 Turning to Slide 26. We're moving on from Borden, so if you have
25 any questions, let me know. Okay.

1 So now we're going to cover the last part, which is the limitations of
2 Claim 12, Demonstrative Slide 25. So Claim 12 of the '516 Patent recites,
3 "The solar of Claim 9 wherein the second metal contact comprises silver
4 formed over a layer of silicon dioxide. Petitioner argues that screen printing
5 taught by Froitzheim teaches the formed over element of Claim 12 of the
6 '516 Patent. This is not true. Froitzheim's screen printing is not formed
7 over a layer of silicon dioxide.

8 JUDGE KALAN: Before you go any further, do we need to construe
9 formed over, or are you going to proceed without using a particular
10 interpretation?

11 MR. PETERSON: I don't think we need to construe it. I think
12 formed over means formed on top of or formed over.

13 JUDGE KALAN: Thank you.

14 MR. PETERSON: Turning to Slide 26. The Board should not
15 consider Patent Owner's proposed Froitzheim-Gan combination under Claim
16 12, which is based on an alternative embodiment of Froitzheim. This
17 alternative embodiment includes an additional passivation layer 34, and rear
18 contacts 35, and a finger structure. For Independent Claim 9, from which
19 Claim 12 depends, Petitioner said that the screen printed embodiments
20 should be used for the metal contacts and did not say to the finger structure
21 embodiment.

22 Now, for Claim 12, or Dependent Claim 12, Petitioner has said that
23 the finger structure is the second metal contact. The second contact is
24 accomplished by screen printing Independent Claim 9. You cannot use a
25 different method for an independent claim that depends from Claim 9.
26 Patent Owner fails to explain how this alternative embodiment would be

1 modified with Gan or whether a POSITA would have been motivated before
2 in such modifications. Thus, the Board should not consider Patent Owner's

3 --

4 JUDGE KALAN: At time. I am happy to keep the time going. I just
5 wanted to let you know you're at 45 minutes.

6 MR. PETERSON: Okay. I'm at one more slide, so I'll just probably
7 take another minute, and then I'll be done. Thank you, Your Honor.

8 Turning to Slide 27. Patent Owner also improperly equates
9 Froitzheim disclosure of its rear contacts 35 forming after the passivation
10 layer with the Claim 12 limitation of silver formed over a silicon dioxide.
11 Petitioner points to a couple of phrases that say that the finger shaped
12 contacts can be laid down before or after the passivation layer. Petitioner
13 wants this Board to believe that the contacts are over the passivation layer
14 because they're formed after.

15 However, that is not the case. The screen-printed fingers are shot
16 through the passivation layer by firing the squeegee paste, and this important
17 in order to make electrical contact with the P region. So you can see that
18 contacts 35 are actually in contact with the layer 10 of P region. Froitzheim
19 also tells us that between the fingers of passivation layer 34 in green is the
20 contacts, which are 35. That is exactly what is shown in Froitzheim Figure
21 3.

22 Thank you, Your Honor. I'll reserve the rest of my time.

23 JUDGE KALAN: Thank you. I have you at about 47 minutes with
24 13 minutes remaining.

25 MR. PETERSON: Thank you.

1 JUDGE KALAN: Thank you. Turn it back over to Petitioner's
2 counsel, and you can begin whenever you're ready. I have you at 24
3 minutes remaining.

4 MS. BOLL: Thank you, Your Honor. I'd like to begin discussing
5 Patent Owner's argument that there are disadvantages associated with
6 doping at the lower end of the Froitzheim range. I'm not aware of anything
7 in the record to suggest that there is a disadvantageous result from doping
8 polysilicon at 900 degrees Celsius or otherwise at the sort of below 1000 end
9 of Froitzheim's range. In fact, Dr. Ruby actually admitted, Patent Owner's
10 expert admitted he has no experience doing polysilicon deposition and his
11 only experience is doing diffusion directly into the substrate as in
12 Froitzheim. This is in the Ruby deposition at pages 87 to 88. Thus, he
13 could not speak to this issue.

14 Froitzheim itself also does not speak to this issue. Froitzheim said
15 1000 degrees is preferred but does not explain how the results would be
16 worse at 900 degrees, and in fact, given Froitzheim's silence as to time and
17 the diffusivity dependent on both temperature and time, Froitzheim leaves
18 open the possibility that you could achieve just as preferred of a result,
19 annealing at, for example, 900 degrees for a longer period of four hours as
20 Gan suggests versus 1000 degrees for 30 minutes, the other end of the other
21 option in Gan.

22 I want to share my screen to discuss Dr. Banerjee's testimony
23 regarding the junction depth. This appears at page 85 of Exhibit 2023.
24 Patent Owner suggests that Dr. Banerjee agrees that using a lower
25 temperature would make Froitzheim worse, but this is not the case. Dr.
26 Banerjee was asked why would they prefer to use 1000 to 1100, "they"

1 being Froitzheim, and he qualifies his testimony. He says, “Everything else
2 being the same,” on page 86, “you get a deeper junction and a higher
3 concentration at the surface.” But everything else is not the same in
4 Petitioner’s proposed combination because you’re using -- in Petitioner’s
5 proposed combination, you’re using a polysilicon emitter instead of a
6 monocrystalline silicon emitter.

7 Patent Owner also misinterprets what the Petitioner argues. If we take
8 a look at page 47 of the petition, it describes the combination, and here
9 Petitioner explains, “Before introducing the boron dopant by diffusion at the
10 rear side of the substrate as in Froitzheim, a skilled artisan would perform
11 Gan’s steps of thin thermal oxide growth to form the interfacial layer and
12 polysilicon deposition to form the polysilicon, after which the polysilicon
13 would be doped instead of the substrate to form the polysilicon emitter.”
14 And there Petitioner cites to Gan, so in fact, it’s not the case that Petitioner’s
15 position is Froitzheim’s range must be used. Similarly, in the ‘053 petition,
16 if we take a look at page 36 of that petition, Petitioner actually specifies it’s
17 either steps 9 and 10 of Gan or the doping procedure described in
18 Froitzheim.

19 Furthermore, Froitzheim is silent because a person of ordinary skill in
20 the art would understand how to optimize parameters like temperature and
21 time. This wasn’t argued perhaps in the briefing very fleshed out because it
22 was a new argument from Patent Owner in the Surreply that Petitioner
23 should have disclosed the specific anneal time and anneal temperature. It’s a
24 new argument. The claims of the ‘516 and ‘053 Patents are silent about
25 doping temperature and time. The specification is also silent about doping
26 temperature and time.

1 Between Froitzheim and the patents at issue here, it's very clear that
2 the lack of disclosure suggests a POSITA would understand how to adjust
3 temperature and time by 2008 as part of routine optimization rather than
4 undue experimentation. And Petitioner's Reply includes some case law to
5 this effect, including the *Lockwood v. American Airlines* case, 107 F.3d 1565
6 from the Federal Circuit, and a case from the Northern District of California,
7 which was affirmed by the Federal Circuit, *eBay v. Kelora*. And those cases
8 recognized that a patent need not teach and preferably omits what's well
9 known in the art, and thus, it makes complete sense that Froitzheim as well
10 as the '516 and '053 all omit the anneal temperature and time because those
11 are things that would have been part of routine optimization rather than
12 undue experimentation.

13 I'd like to also address Patent Owner's arguments regarding the Gan
14 thesis. Gan itself had Swanson as an author on it. Swanson was a pioneer in
15 the industry, as I think the parties agree. He would not have put his name on
16 a paper to be presented to the industry if we thought that there was no
17 reliable oxide recipe and that was not reported in the industry. His role as
18 the professor signing off on a PhD thesis is different from putting his name
19 on a paper to present to the industry. The paper reflects the work of
20 someone beyond ordinary skill. The thesis reflects all of the
21 experimentation conducted by a graduate student, who as far as we know
22 was not a POSITA.

23 This is just a common-sense argument. The later date on the thesis
24 does not reflect anything with regard to the importance of the work. It could
25 be reflective of something like the timing of the thesis defense, whereas

1 Swanson putting his name on a paper shows that he's drawn an important
2 conclusion for the industry to take away.

3 Finally, if the Board is to consider the Gan thesis, I'd like to share my
4 screen to discuss pages 111 to 112 of the Gan thesis. Sorry. The Gan thesis
5 reports it is possible than thin oxide growth can be improved by improving
6 the oxidation at lower temperatures such that the oxidation rate can be
7 controlled more precisely. This is not just speculation, as Patent Owner
8 claims. On page 111, Gan reports about calibration of the oxide growth
9 recipe by actually carrying out different time periods and different lengths of
10 time of oxygen flow. So while Gan did not apparently vary the temperature,
11 lower the temperature to control his oxide rate, this conclusion is based on
12 other calibration that he did perform, and that's reflected on pages 111 to
13 112 of the thesis.

14 I'd like to also respond briefly to a couple of Patent Owner's
15 arguments regarding some of the references in Petitioner's Reply.
16 Discussing Petitdidier, the arguments that Patent Owner makes really miss
17 the point. The point of that Petitdidier reference is that a POSITA applying
18 to the teachings of Froitzheim would have a reasonable expectation of
19 success, and the level of skill is such that those in the art understand how to
20 optimize the growth of a chemical oxide. It's not that the exact result in
21 Petitdidier would be exactly what a person of ordinary skill would expect in
22 combining Froitzheim and Kwark. This is not a new argument; this is merely
23 supporting Petitioner's position that adjusting parameters is well within the
24 level of skill.

1 Furthermore, it is unclear where Patent Owner got the thickness of 10
2 to 50 angstrom that Patent Owner referenced in argument. I believe it comes
3 from the patent specification of the '516 and
4 053 Patents, and I don't believe it comes from anywhere in Kwark. But the
5 point remains that the patent doesn't say anything about temperature or time
6 for growing the oxide layer, again strongly suggesting that growth of an
7 oxide layer is well within the knowledge of a POSITA.

8 On the Merabet reference, nothing in the Surreply or in what Patent
9 Owner was arguing today rebuts what Petitioner is using the Merabet
10 reference for, which is, again, to corroborate Dr. Banerjee's explanation of
11 what one skilled in the art would understand. And one skilled in the art
12 would understand that it is easier to diffuse polysilicon than monocrystalline
13 silicon, and that's reflected in Merabet's discussion of the boron diffusion
14 coefficient being 50 to 200 times greater than in monosilicon.

15 What Merabet Figure 7 plots is not diffusivity but actually diffusivity
16 enhancement, which is not the same thing. It's a relative. It's increase of
17 polysilicon diffusivity relative to monocrystalline silicon as a function of
18 depth and temperature. So the attempts that Patent Owner makes to suggest
19 that Merabet is inconsistent with Dr. Banerjee's testimony is inaccurate.

20 I'd also like to respond to Patent Owner's argument regarding Kwark
21 and that there would be severe outdiffusion at 1000 degrees Celsius. So
22 Kwark did describe a phenomenon observed at 1000 degrees Celsius as
23 severe outdiffusion, but again, as mentioned, there is still a significant
24 improvement in J zero at 1000 degrees between Froitzheim aluminum
25 contact versus the chemox samples. And further, again, consistent with
26 Froitzheim and where Kwark has reported the most benefits, the natural

1 conclusion from reading Froitzheim and Kwark together is to just anneal at
2 900 or 950 degrees as opposed to above 1000 degrees.

3 I'd like to briefly touch on Claim 12, which begins on Slide 43, which
4 begins on Slide 43 of the demonstratives, Exhibit 1088 in the 1039
5 proceeding and Exhibit 1103 in the 1040 proceeding. The claim recites that
6 the second metal contact comprises silver formed over a layer of silicon
7 dioxide. If we turn to Slide 44, the silicon dioxide corresponds to number
8 34, the passivation layer, and the metal contacts are number 35 arranged in a
9 finger structure where only a portion of the back is screen printed to reduce
10 the amount of metal material that's required.

11 JUDGE KALAN: Counsel, I'll ask you the same question. Do we
12 need to construe formed over?

13 MS. BOLL: No, Your Honor. There is no construction needed here.
14 As described in Froitzheim, the passivation layer of silicon dioxide can be
15 applied either before or after the metal contacts are formed. So in an
16 embodiment of Froitzheim where the second metal contacts 35 are formed
17 over a silicon dioxide layer, that's there in Froitzheim because Froitzheim
18 has disclosed that the rear contacts may be formed after a passivation layer
19 of silicon dioxide is deposited.

20 Are there any further questions?

21 JUDGE KALAN: I did have a question about Patent Owner's
22 assertion regarding the combination with Borden and differences,
23 specifically the HIT portion and the combinability. Could you speak to that,
24 please?

25 MS. BOLL: Yes, Your Honor. With regards to Borden, so Borden
26 discloses both a polysilicon emitter as well as an amorphous silicon

1 embodiment, so it's both embodiments. And certainly, although the
2 amorphous silicon embodiment was perhaps more of the focus, that doesn't
3 mean that Borden does not disclose advantages from a polysilicon emitter.
4 This is a perfect example of something like an alternative design. And
5 disclosure of those, something like an alternative design, doesn't mean that
6 that combination isn't apt for obviousness purposes, and that's described in
7 the case *In re Mouttet*, 686 F.3d 1322, Fed. Cir. 2012. Just because there are
8 other alternatives in the prior art doesn't mean that the polysilicon
9 embodiment is not adequate for obviousness purposes, and Dr. Banerjee
10 provided both in his deposition testimony, which is reprinted on
11 demonstrative number 42, and in his report, in his declaration in support of
12 the Petition, that the advantages disclosed, while described by Borden as
13 applying to amorphous silicon do also apply to polysilicon.

14 And it's not the case that we -- these are just different things that
15 would motivate a POSITA. Patent Owner's arguments were essentially
16 almost running into expectation of success or what is actually the
17 construction we're proposing. The point is that these different advantages,
18 such as preventing epitaxial growth or protecting the surface from plasma
19 damage, would motivate the POSITA to look at this combination, not
20 necessarily that we're trying to introduce additional steps into the process.

21 JUDGE KALAN: So the statements on 23 of Patent Owner's
22 demonstratives that were in support of the benefits are not directed to
23 polysilicon emitter cells, would you characterize that as incorrect, or are you
24 just saying that all the benefits can apply in some way or another to
25 polysilicon emitter cells?

1 MS. BOLL: I would say it's not accurate. While Borden itself
2 describes the particular benefits in the context of the amorphous silicon
3 embodiment, Dr. Banerjee explained that those same benefits are applicable
4 to polysilicon embodiments, and that would be reflective of the
5 understanding of one of ordinary skill.

6 JUDGE KALAN: And the argument on page 24 of Patent Owner's
7 demonstratives where the orange highlighting indicates what I believe Patent
8 Owner said was a new argument. Could you respond to that?

9 MS. BOLL: Yeah. So Dr. Ruby had provided some testimony that
10 the use with a point contact structure to increase efficiency is the type of
11 benefit that could apply to a polysilicon emitter construction, and so that's
12 what we were highlighting in our Reply was that testimony from Dr. Ruby
13 that had been listed in the interim. Again, this is part of the motivation to
14 look at Borden in combination with Froitzheim as opposed to some new
15 structural aspect that we need to add to the mechanics of the combination.

16 JUDGE KALAN: Thank you.

17 MS. BOLL: Thank you, Your Honors.

18 JUDGE KALAN: Patent Owner, I believe we have about 13 minutes
19 remaining, and you're welcome to start whenever you're ready.

20 MR. PETERSON: Okay. Thank you, Your Honor. Let's start with
21 the Borden benefits. Nowhere in Borden does it say that those benefits
22 apply to polysilicon films. And you're supposed to look to the actual
23 reference itself to find a motivation to combine, not look to your outside
24 expert who is being paid for this trial. The point contact structure was
25 absolutely a new argument. They could have pointed to the point contact
26 structure in their Petition. They did not. It did not come up until the Reply,

1 and as I discussed, the point contact structure is not even a structure that they
2 propose be used in their combination. They're just trying to point to
3 anything, anything at all in Borden that could be used with polysilicon.

4 I noticed counsel also never discusses the disparagement that the Gan
5 thesis has of how it used its thermal oxide because they can't. I mean, it's
6 very clear in the Gan thesis when he's talking about the Gan reference that
7 he was not able to get it to work, and that's very important here because
8 they're trying to make a combination that takes a structure that doesn't work
9 in the first place and make combinations to it that bring it outside its
10 preferred range, which do have negative consequences.

11 It lowers, decreases the junction depth and it decreases diffusion, and
12 now what they're trying to do is say, yeah, but we don't really know what
13 that's going to do because we're doing it in a polysilicon now and not
14 regular monocrystalline silicon. Well, that's just adding a third variable to it
15 to the already two variables that we didn't know what was going to happen.
16 So that doesn't make things better. That makes it worse. That makes us not
17 know at all how this thing is going to perform.

18 Also, I'd like to say that Petitioner never disputed the context of Dr.
19 Banerjee's testimony regarding junction depth in its Reply or its
20 applicability to the Froitzheim-Gan combination. Petitioner also never
21 disputed that Froitzheim's anneal temperature should be used in its Reply or
22 Dr. Banerjee's testimony to that effect.

23 Patent Owner's argument that Petitioner should have disclosed
24 temperature and time is in response to Petitioner's hand-waving argument
25 that a POSITA would have known to adjust it without explaining how a
26 POSITA would do so. So they're trying to make it sound like we're

1 bringing in a new argument, but that's just in response to them saying, yeah,
2 a POSITA would know how to do this. And we're saying, yeah, but you
3 don't even have the temperature and time to be able to do that.

4 They also keep making the claim by bringing up other references that
5 growth of an oxide layer is well within the skill of a POSITA, and mostly
6 they point to transistors, which have a very different size, a very different
7 makeup, and are used for a different function. One is capturing sunlight and
8 transferring it to electrons and passing those electrons, so one gets very hot,
9 one gets a lot of sun pounding down it.

10 But you'll notice that when you try to move them to a solar cell, can't
11 get it to work at this time. Now they can do it, but at the time of the patent,
12 Gan is telling us he has this, as counsel said, this world-renowned solar cell
13 person, Swanson, as a thesis advisor, and he can't get it work. And he can't
14 get it to work after he looked at Kwark. Looked at Kwark and decided no,
15 that's not going to work, and I can't get it to work.

16 So all of this hand-waving that, you know, it was easy, anybody off
17 the street would know to make an oxide layer is (audio interference) attorney
18 argument. The specification says you can do it after, but you shoot it
19 through, you squeegee it through the paste. So it's not formed on top of; it's
20 formed through in Froitzheim, so it doesn't meet the claim.

21 That's all, Your Honors. Thank you for your time.

22 JUDGE KALAN: Counsel, we appreciate your thorough
23 presentations and taking our questions. This case is submitted to the panel
24 for determination and preparation of the final written decision. We are
25 adjourned. I will ask the parties to stay on the line if the court reporter has
26 any questions. Thank you.

1 MR. PETERSON: Thank you.
2 (Whereupon, the above-entitled matter went off the record at 2:52
3 p.m.)

IPR2024-01039 (Patent 8,222,516 B2)

IPR2024-01040 (Patent 8,878,053 B2)

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